WIRE AND WIRE PRODUCTS

JANUARY 1945

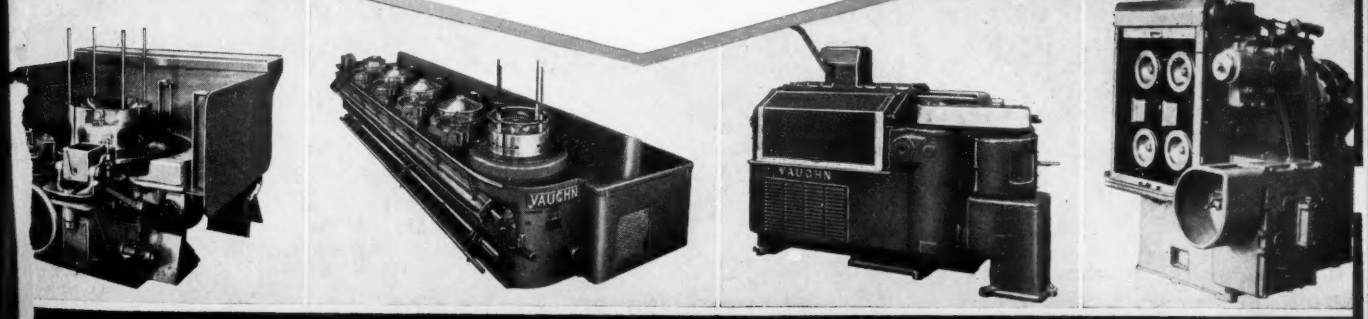
1945

...Year of Eventful Change

To Operating Executives of The Wire Industry:
DURING THIS TURBULENT YEAR, VERSATILITY AND FLEXIBILITY IN THINKING . . . IN PRODUCTION . . . AND IN THE EQUIPMENT OF PRODUCTION ITSELF
. . .WILL BE PARAMOUNT CONSIDERATIONS

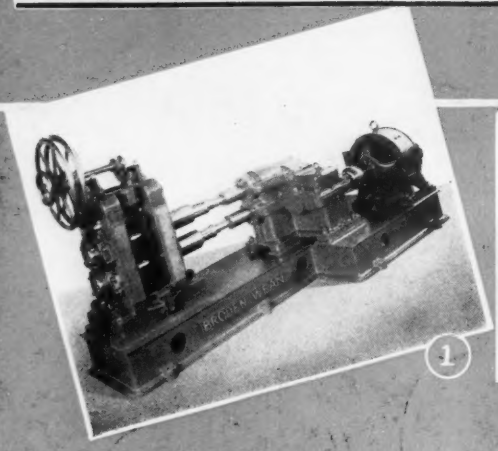
VAUGHN WIRE DRAWING MACHINERY
Is Equally Versatile, Equally Flexible, Equally Dependable for War or Peacetime Production.

THE VAUGHN MACHINERY CO., CUYAHOGA FALLS, OHIO



ICIAL PUBLICATION OF THE WIRE ASSOCIATION

WEAN-BRODEN



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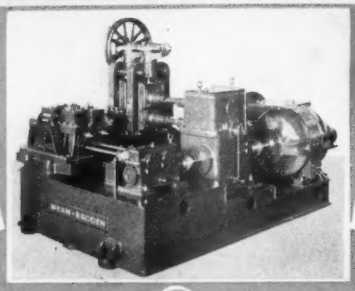

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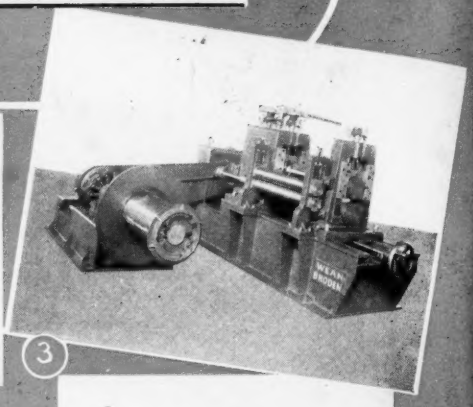

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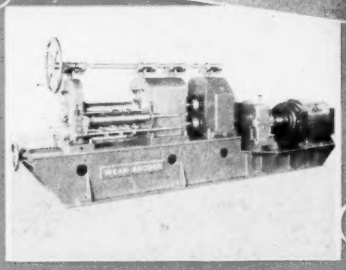


4

1. Small Cold Rolling Strip Mill
2. Special Strip Cold Rolling Mill
3. Strip Reel and Slitting Unit
4. Heavy Duty Slitter
5. Special Alloy Single Draft Heavy Duty Vertical Wire Drawing Block for 5/8" Round Rod

THE Wean Engineering Company, Inc., have long been recognized as Specialists in sheet, strip and tin mill equipment. . . . The Broden Construction Company specializes in the manufacture of narrow strip and wire mill equipment.

With the extended facilities of The Broden Construction Company as a subsidiary of The Wean Engineering Company, Inc., it is now possible to serve the steel industry more effectively.

COLD ROLLING MACHINERY

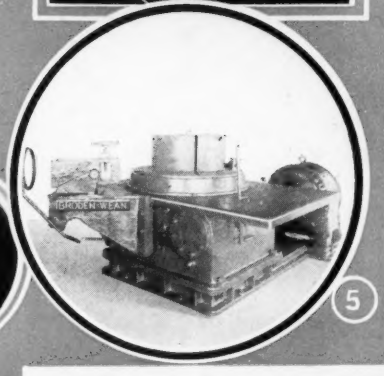
For 36" Wide Material and Narrower

Mills • Reels • Slitters • Levelers • Coilers • Edgers
Scale Breakers • Shears • Scrap Ballers
Continuous Pickling

WIRE MILL EQUIPMENT

Wire Drawing Machines • Patenting • Galvanizing and Tinning Take-Up Frames • Wire Flattening • Spoolers
Nail Galvanizing and Blueing

HOLMQUIST BARBED WIRE *and* WIRE FENCE MACHINERY



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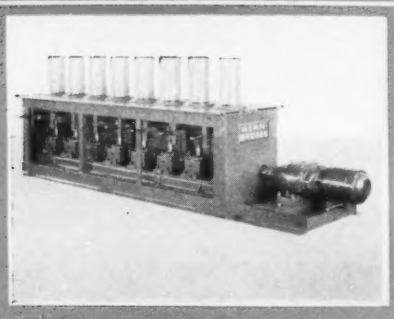
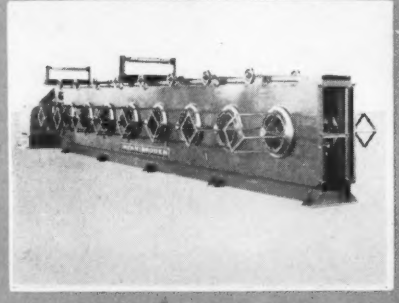
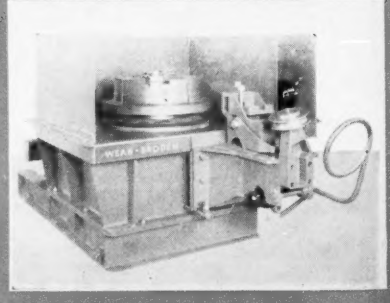
The BRODEN CONSTRUCTION Co., Inc., Cleveland, O.
A SUBSIDIARY COMPANY OF
The WEAN ENGINEERING Co., Inc., Warren, O.



FINE WIRE TINNING UNIT

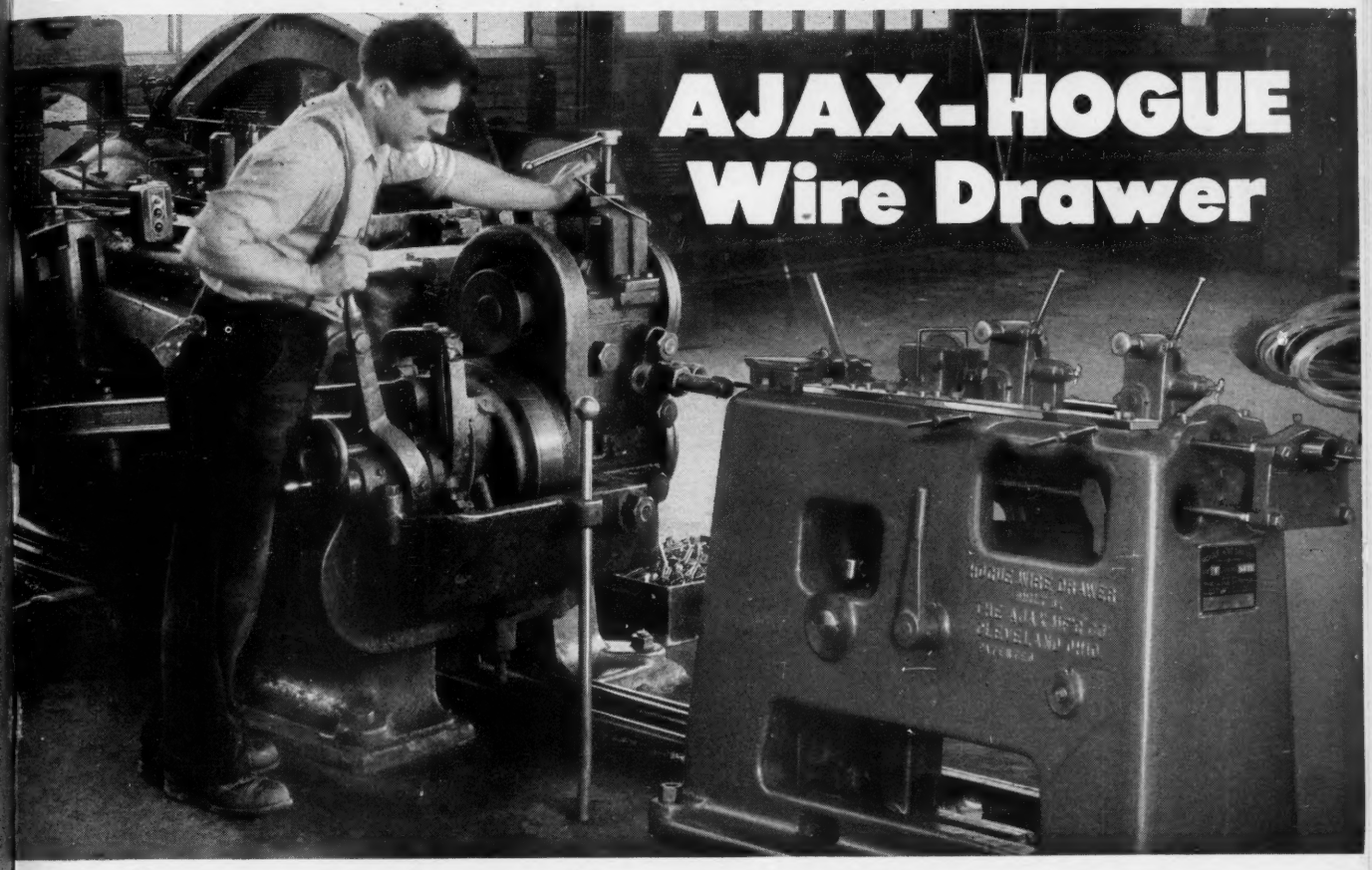


MULTIPLE WIRE TAKEUP FRAME



TWO DRAFT CONTINUOUS WIRE DRAWING MACHINE

This Attachment for Cold Headers



Lowers Material and Heading Die Costs... Steps up Quality and Accuracy

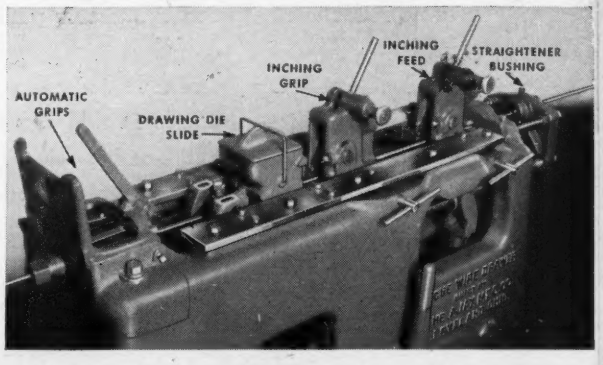
The Ajax-Hogue Wire Drawer makes it possible to produce highest quality cold headed products from less costly hot-rolled stock instead of cold drawn wire.

Header die life is greatly increased, especially on close specification products, due to the clean, straight, accurate wire freshly drawn from hot rolled, pickled and limed rod, and fed into the header dies immediately after drawing.

In the smaller wire diameters, commercial drawn wire is redrawn for diameter accuracy and straightness when heading many Class 3 products, for uniformity of finished product with better die life.

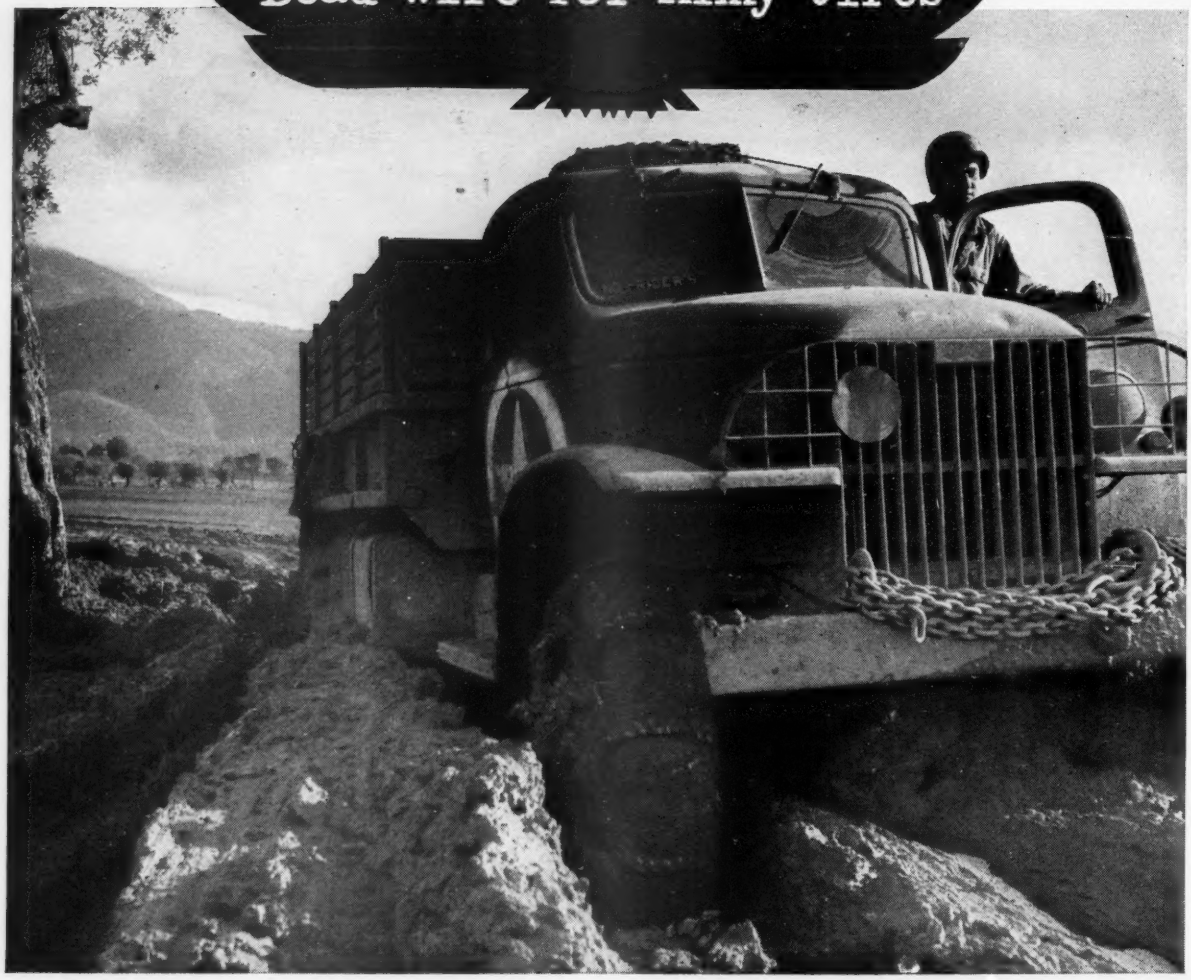
Write for Bulletin No. 111

The Ajax-Hogue Wire Drawer can help you cut heading costs and improve your close tolerance headed products.



THE AJAX MANUFACTURING COMPANY
EUCLID BRANCH P. O. CLEVELAND, OHIO
621 MARQUETTE BUILDING • CHICAGO, ILLINOIS

Bead wire for Army tires



When Army trucks and combat cars plow along through hub-deep mud in battle-area roads, often over no roads at all, that means terrific punishment for tires.

Much of the tire-bead wire in use today—and Army tires use lots of it—originates in the wire mills of Bethlehem. We supply high-carbon steel process wire and bright wire to processors. After redrawing, coating and fabricating operations, the wire is woven into a tape which is firmly molded to the rubber for greater tire strength.

Bethlehem wire is serving in a multitude of essential tasks today, both in distant fighting zones and on the busy production front at home. Field telephone systems, fragmentation bombs, armored cables and gun springs are but a few random examples of the every-day necessities of war in which steel wire from Bethlehem mills is being used in enormous quantities.

BETHLEHEM STEEL COMPANY, Bethlehem, Pa.

BETHLEHEM STEEL

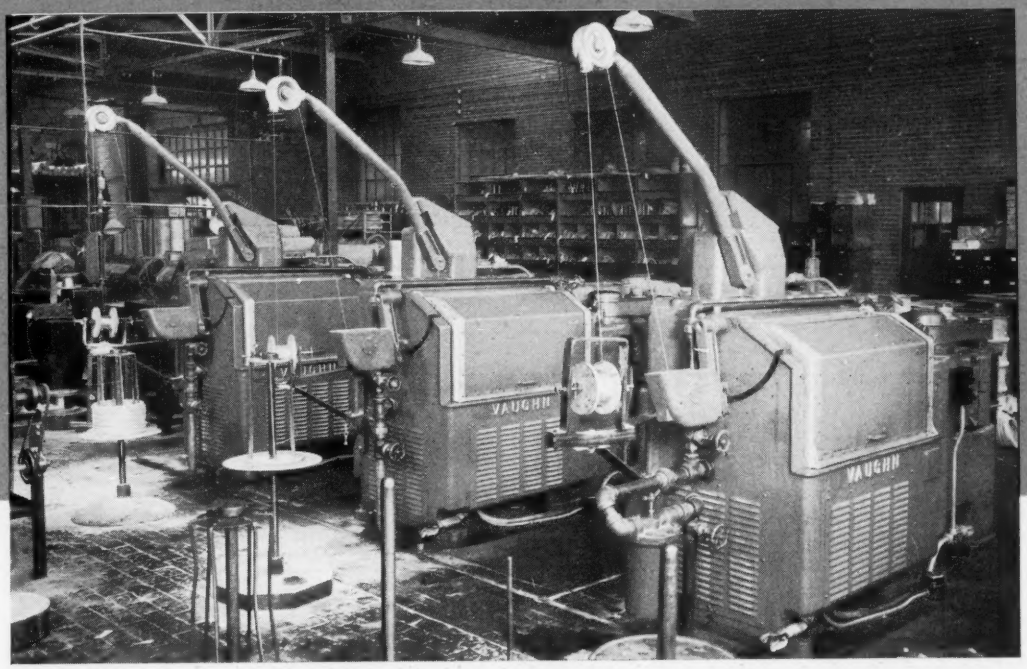
Bethlehem Steel Export Corporation, New York City

WHY BE SATISFIED WITH ANYTHING LESS THAN

APEX

DRAWING LUBRICANTS

for NON-FERROUS METALS

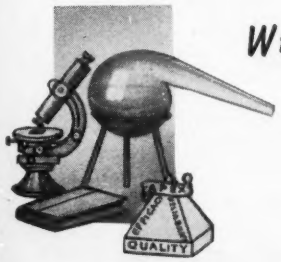


In mills like this all over the country, wherever fine wire is being drawn, you'll find Apex Drawing Lubricants doing an outstanding job.

For Continuous Wet Drawing of Aluminum, Copper, Brass and Bronze Wires and Their Alloys

An extreme pressure lubricant with low surface tension, Apex "BB" assures good wetting of the wire and the prevention of excessive metal dust and dirt flow. Emulsion stability is good even in hard water. For drawing sizes of wire for reductions down to and including .008, Apex "BB" is recommended. For drawing below this size use Apex "SFV" Wire Drawing Compound.

"SFV" is a heavy transparent liquid compound, soluble in either hot or cold water, for the drawing of non-ferrous fine wire. It is especially suitable for wire that is to be enameled where free running is necessary. Because pH is controlled, "SFV" will not stain or attack non-ferrous metals.



WHY BE SATISFIED WITH LESS?

Day in and day out, more mills are changing to Apex. Why not have an Apex engineer call to discuss Wire Drawing Lubricants in terms of your own requirements.

PHONE, WRITE OR WIRE TO

APEX ALKALI PRODUCTS CO.

MAIN & RECTOR STS., PHILADELPHIA 27, PA. • PHONE: Manayunk 0969—North 0074

IMPORTANT NOTICE

TO

ALL SUBSCRIBERS

regarding the

WIRE & WIRE PRODUCTS BUYERS GUIDE AND YEAR-BOOK
OF THE WIRE ASSOCIATION

✦ ✦ ✦

Beginning with the 1945 Edition of this useful directory, subscribers may obtain copies at 40% discount from the list price of $5.00 per copy. So when ordering your subscription to WIRE and WIRE PRODUCTS, if you want a copy of the BUYERS GUIDE, please enclose $3.00, or send the order and ask us to bill you.

Members of The WIRE ASSOCIATION will continue to receive a copy of the BUYERS GUIDE as part of the service extended to them, and the cost is included in the dues.

TO ALL OTHERS THE PRICE REMAINS AS HERETOFORE, $5.00 PER COPY.

THE BUYERS GUIDE is a complete directory of all kinds of wire and wire products manufactured in this country, together with listings of all manufacturers of machinery, equipment, supplies and services used by the Wire Industry.

It is an invaluable source of information on everything of interest to wire men. Be sure to order your copy early to be certain of getting one, as the edition is limited. Published in the Spring annually. Only $3.00 to subscribers.

If interested in advertising, please write for rates.

WIRE & WIRE PRODUCTS

300 MAIN STREET

STAMFORD CONNECTICUT

A complete line...

OF WIRE DRAWING AND ACCESSORY EQUIPMENT
DESIGNED, ENGINEERED AND BUILT IN OUR NEW PLANT

RODBLOCKS • WIRE DRAWING MACHINES • STRANDERS • CLOSERS • CABLERS • ARMORING MACHINES • TAPERS • JUTERS • SERVING HEADS • COMPOUND TANKS • SATURATING TANKS • CAPSTAN SECTIONS • PAY OFFS • RE-REELERS • RESPOOLERS • CAPSTAN TAKE UPS • HEAVY DUTY TAKE UPS • MEASURING MACHINES • COILERS • WIRE COVERING MACHINES • PORTABLE CUT-OFF MACHINES • INSULATING MACHINES • ELECTRIC ROD POINTERS • DIE STRINGING MACHINES • WIRE ROPE MACHINERY • TINNING MACHINERY • MAGNETIC SLIP CLUTCHES AND SPECIAL MACHINERY • RAWSON CENTRIFUGAL CLUTCH-COUPLINGS

The new Syncro plant at Perth Amboy, N. J., is completely equipped to adequately meet every requirement of the wire and cable industry. We will welcome your inquiries.

SYNCRO MACHINE COMPANY

113 SOUTH JEFFERSON STREET
CHICAGO 6, ILL.
REPRESENTED IN CANADA BY
CANADIAN ELEVATOR EQUIPMENT CO.
TORONTO

EXECUTIVE OFFICES AND GENERAL WORKS—611 SAYRE AVENUE, PERTH AMBOY, N. J.

Machinery for the Wire Industry

SYNCRO

FIDELITY Wire-Spooling Systems

for production speed and smooth lay ★ ★ ★

There are a dozen types of FIDELITY Wire-Spooling Machines to take care of wire from 16 gauge B&S to diameters as low as .0015".

Each gives you accurate winding and uniform lay. Simple to operate, variable speed and traverse, readily adjustable to different size spools, can be equipped with stop motions and brakes to prevent over-running. They may be had to wind from spools, reels or coils or, in some cases, directly from production machines or annealing furnaces. Available in single or multiple units.

Whether you wind large or small spools, sticks or quills, fine or coarse wire in single or multiple ends, you will find FIDELITY Wire Spoolers adaptable, adjustable, economical.

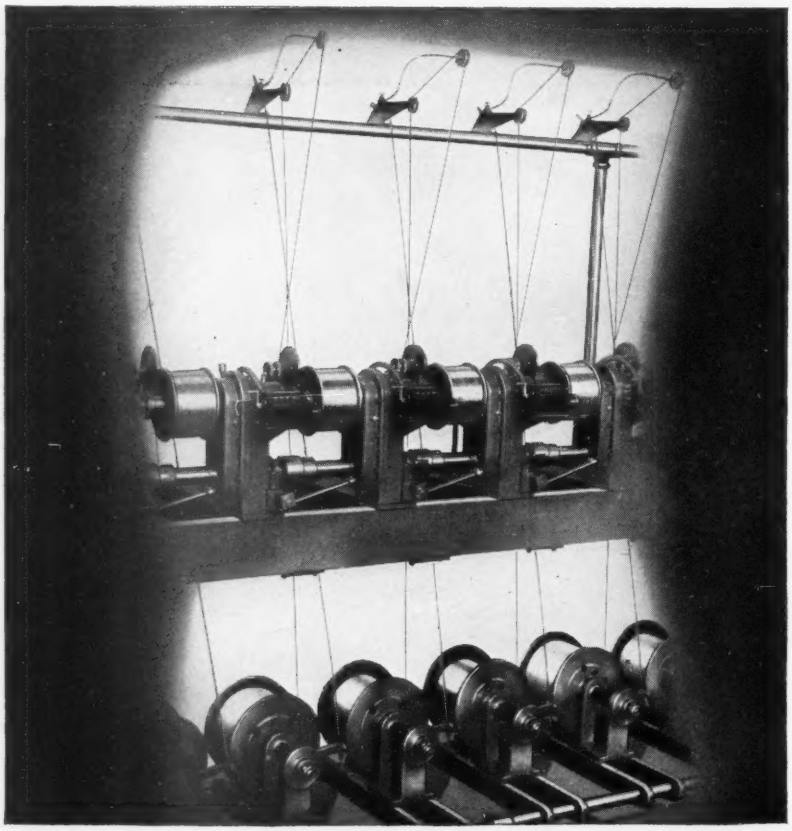
For war- or peace-time production, you gain by the multiple advantages from FIDELITY Wire-Spooling Systems. Used by electrical and mechanical equipment manufacturers throughout the country.

Write for special bulletin.

★ ★ ★

Close-up of four sections of a 12-Head FIDELITY Spooling Machine with screw traverse, tension compensators, stop motion, yardage counters, variable speed, individual clutches and many other time- and labor-saving devices.

★ ★ ★



To Hasten Peace, Buy More Bonds

Makers of Automatic Precision Machines

FIDELITY
MACHINE COMPANY

★

3908-18 FRANKFORD AVE., PHILADELPHIA 24, PA.

MASTER
TUNGSTEN CARBIDE DIES

Greatly improved TUNGSTEN CARBIDE DIES are now produced by the latest methods under strict laboratory control. Through continuous research Master is able to offer manufacturers new standards of quality and performance in dies. Many improvements have been pioneered by us, some of which are exclusively found in Master dies.

Our research staff is ready at all times to help you solve your production problems and to keep you informed of developments that will add to your production economies. You are cordially invited to avail yourself of this service.

MASTER DIES

Offer you

SUPERIOR QUALITY • HIGHEST PRECISION
PROLONGED LIFE • EXCLUSIVE FEATURES

MASTER WIRE DIE CORP.

Atlas Terminal **Cooper Avenue**

GLENDALE, N. Y.

Manufacturers of wire, tube, bar, shell, shaped extrusion and cold heading dies, and wear-resisting carbide parts.

Let Magnus Work Out Better Drawing Lubricants For You

Are you getting the drawing speeds you want?

Is die life satisfactory on all your drawing operations?

How about the finish you are getting on your wires? Are you having any troubles with dull finish or scratches?

Magnus has had such success in working out special wire drawing lubricants for specific types of wire and definite drawing methods, that it will pay you to give us an opportunity to design compounds for any of your operations where results are not as satisfactory as you might wish.

Certainly the experience of the last two years where drawing speeds have been boosted to nearly three times what they used to be, by the use of lubricants specifically compounded to attain that goal, indicates that work along these lines will prove well worth while. Magnus has always specialized in producing "tailor-made" wire drawing compounds, although it has also developed a wide range of materials which are giving excellent results over a considerable range of wet, dry and grease drawn wires.

Let us have an outline of the improvements you'd like to make in your drawing operations and if one of our standard compounds will not make make them possible, we will work out a special material with you.

All the improvements you want may not be possible, but experience plus try-out should lead to worthwhile betterment of your operations.

Magnus

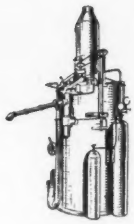
MAGNUS CHEMICAL COMPANY · 188 SOUTH AVENUE · GARWOOD, N. J.

WIRE DRAWING COMPOUNDS

Helping **ROEBLING, GENERAL ELECTRIC, GENERAL CABLE, NORTHERN ELECTRIC, PARANITE, PHILLIPS, TRIANGLE CONDUIT, INTERNATIONAL STANDARD, NATIONAL ELECTRIC and many others**

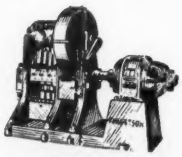
★ *keep War Communications open!*

Cable Lead Encasing Press



Closed Lead Melting Pot

Hydro-Pneumatic Accumulator



High Pressure Hydraulic Pump

Robertson

CABLE LEAD ENCASING EQUIPMENT

is used by the majority of makers of lead encased cable in the United States and Canada

Cables are the veins and arteries of War Communications. The lives of men—the very life of nations—depend on the transmission of messages. Robertson is gratified to have so large a share in the process of making possible these vital messages.

First **FOR OVER 85 YEARS—**

JOHN Robertson COMPANY INCORPORATED

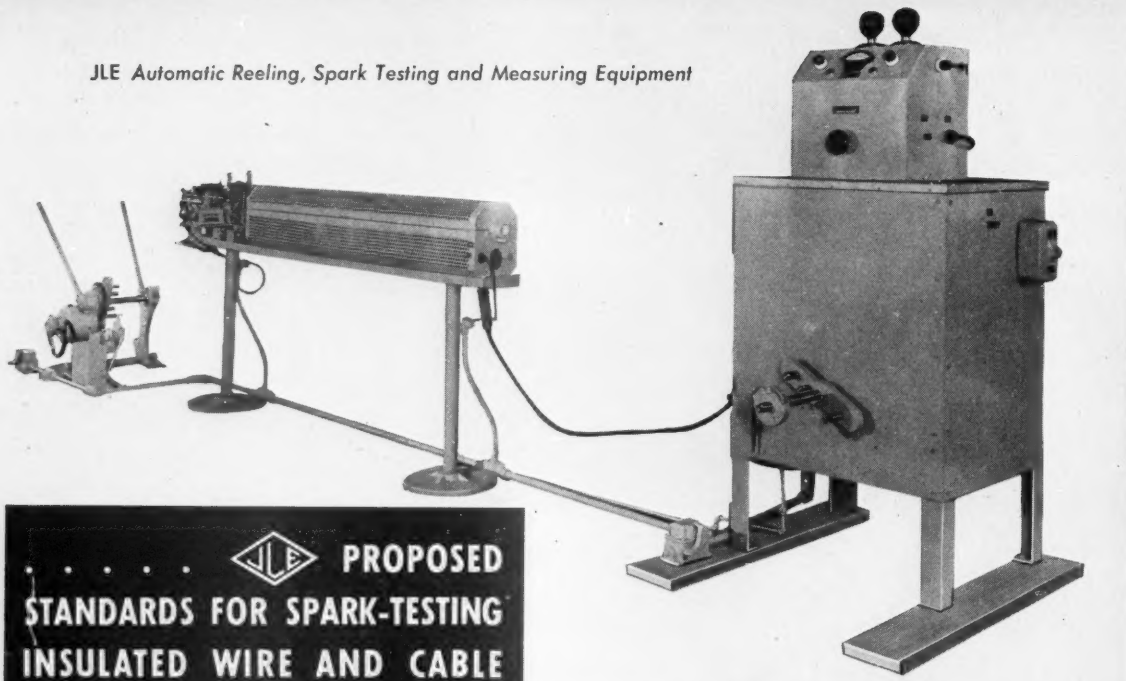
JOHN ROBERTSON COMPANY, INC.
125-137 Water St., Brooklyn, New York

Established 1858 • *Designers and builders of all types of lead encasing machinery for rubber hose and electrical cable manufacturers; including extrusion presses, hydraulic pumps, melting furnaces and pots, hydro-pneumatic accumulators, lead sheath stripping machines and dies and cores.*

Endorsed by America's Leading Wire, Cable and Electrical Manufacturers

AUTOMATIC REELING, SPARK-TESTING AND MEASURING EQUIPMENT – *AND . . .*

JLE Automatic Reeling, Spark Testing and Measuring Equipment



. . . . . JLE PROPOSED STANDARDS FOR SPARK-TESTING INSULATED WIRE AND CABLE

James L. Entwistle Co. has paced the spark-testing field for more than 26 years, originating every improvement in spark-testing equipment during that period. Therefore, it is not surprising that leading wire, cable and electrical manufacturers have equipped 100% with JLE High-Sensitivity equipment, nor that they have adopted JLE proposed spark-testing standards.

JLE High-Speed, High-Sensitivity Sparkers are the only spark-testing machines which are absolutely guaranteed to meet Navy 15-C1 (INT.) specifications, JAN-C-17, JAN-C-76, British and Canadian specifications and all present or future specifications of the Underwriters' Laboratories for spark-testing insulated wire. They will detect a fault which lasts only .001 second and will operate on a capacity fault equivalent to as low as 150 micro-microfarads.

Another exclusive feature of these machines is that they do not require adjustments for varying moisture conditions in the air or on the surface of the wire or cable, or for varying insulation capacities.

Write for your copy of the proposed JLE Spark-Testing Standards, and for copies of the detail specifications of a High-Speed, High-Sensitivity, Type C JLE Wire Sparker, approved bead-chain Electrode Unit and Hand Locator.

JAMES L. ENTWISTLE CO.

43 CHURCH ST., PAWTUCKET, R. I.

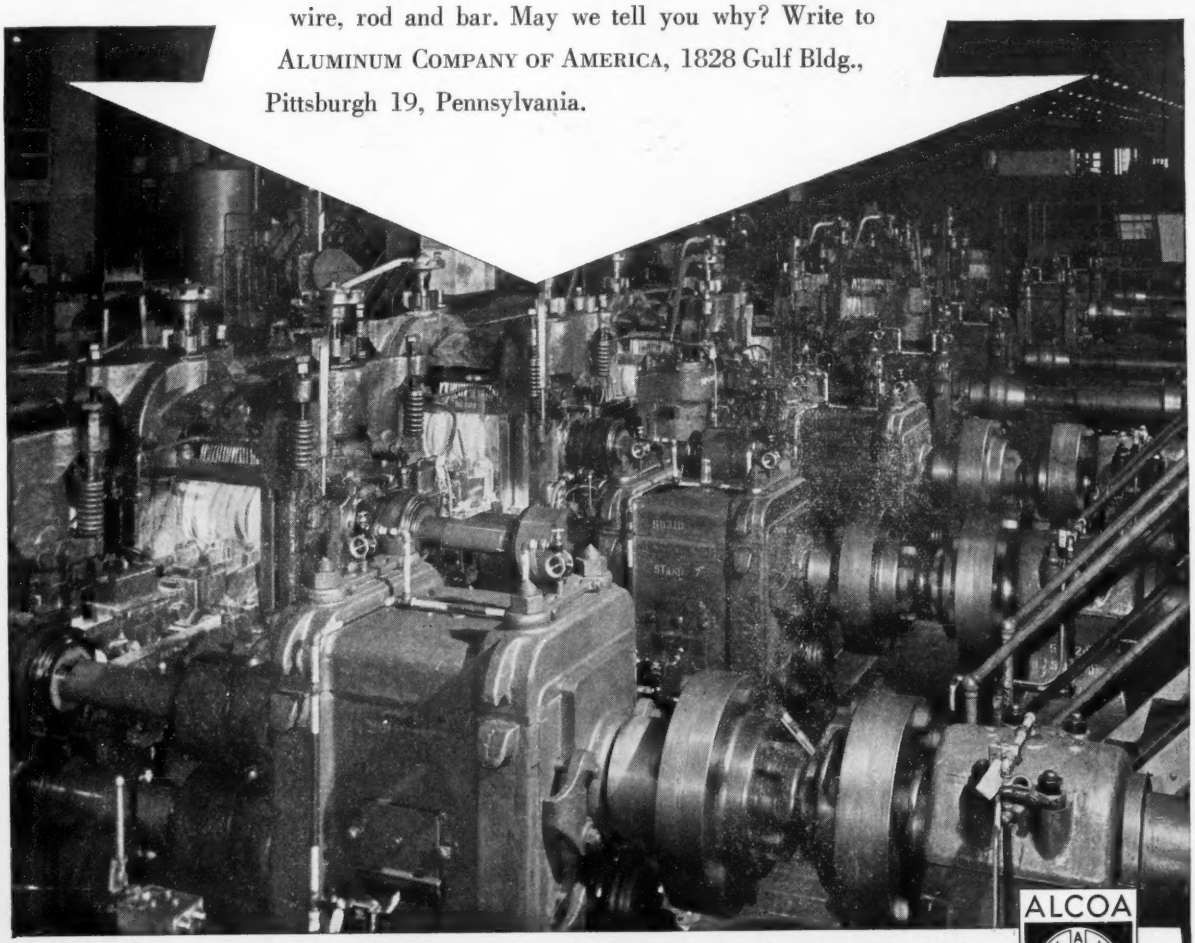
WORLD'S LEADING MANUFACTURER OF SPARK-TESTING EQUIPMENT

This rolling mill is evidence of Alcoa's faith in the future for Aluminum Wire, Rod and Bar

Started as a prewar project, this rolling mill at Alcoa's Massena, New York, plant was rushed to completion to make it available for war production. Aluminum alloy rod and bar stock rolled here has been an important contributor to the war effort.

As wartime demands slack off, the production of this mill will be available to those manufacturers who plan big things with aluminum postwar.

Alcoa has great faith in the future for aluminum wire, rod and bar. May we tell you why? Write to ALUMINUM COMPANY OF AMERICA, 1828 Gulf Bldg., Pittsburgh 19, Pennsylvania.



ALCOA **FIRST IN ALUMINUM**

ALCOA ALUMINUM

Reg. U.S. Pat. Off.

"Steelskin Brands"

Reg. U. S. Patent Office

WIRE, TUBING, STAMPING

DEEP DRAWING SOAPS AND COMPOUNDS

for

Ferrous and Non-Ferrous Metals

"STEELSKIN" CH, WIRE DRAWING METALLIC SOAP POWDER FOR STAINLESS STEEL—EITHER OXIDE COATED AND LIMED—OR LIMED ONLY. ALSO FOR NICKEL WIRE, CONTINUOUS HIGH SPEED HIGH CARBON, AND GALVANIZED WIRE WITHOUT LIME—AND NUMEROUS OTHER DIFFICULT APPLICATIONS.

"STEELSKIN" #15, WIRE DRAWING SOAP POWDER—AN ALL PURPOSE SODIUM TYPE SOAP LUBRICANT.

Back of the "STEELSKIN" TRADEMARK is a Thirty-Five Year Period of Experience in the Development and Manufacture of Soaps and Compounds For Dry and Wet Drawing of all Types of Ferrous and Non-Ferrous Wire.

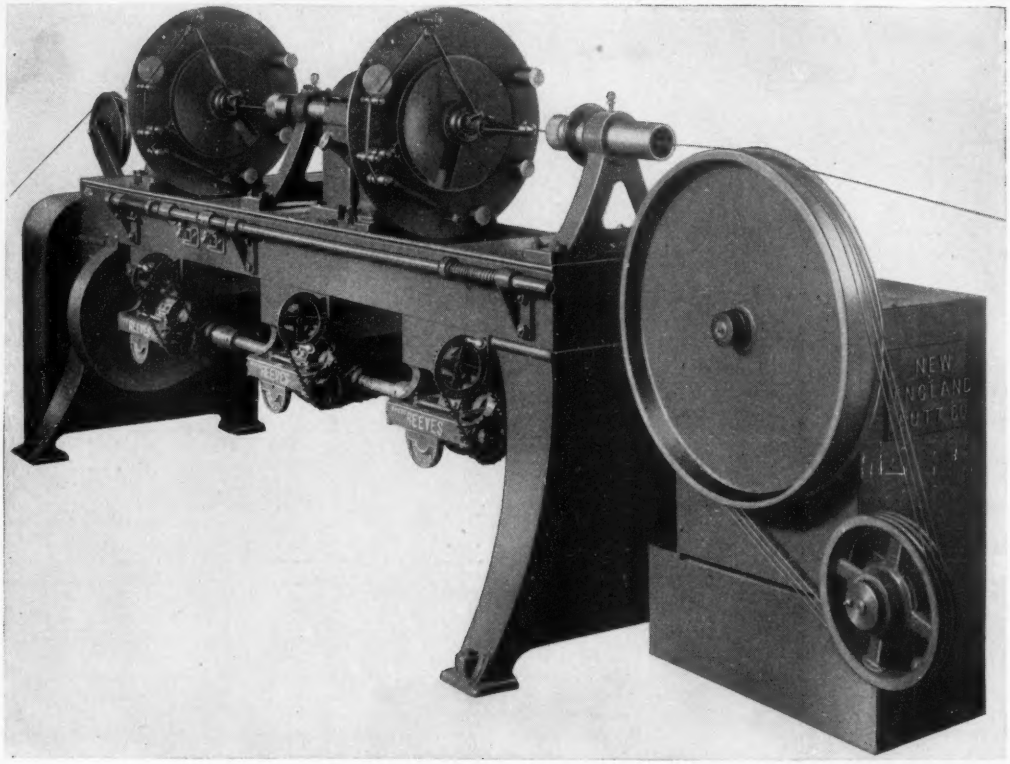
Our Engineers Will Be Glad to Co-operate With You in Finding the Most Economical and Efficient Solution to Your Drawing Problems.

Please Write or Telephone Us.

R. H. MILLER COMPANY

HOMER, NEW YORK

SMALL
HORIZONTAL TAPING MACHINE



The machine illustrated is a small concentric type taping machine for applying paper, rubber, synthetic, or varnished cambric tapes to small wires.

Each head is equipped with variable, forward, reverse, and neutral speed controls.

Automatic stop motions electrically operated and brakes are provided.

We offer these machines in various sizes and with one to four heads.

Machines designed to meet your requirements.

Tell us your requirements

NEW ENGLAND BUTT COMPANY

304 PEARL STREET

PROVIDENCE 7, RHODE ISLAND, U. S. A.

PREVENT WASTE

with RODINE

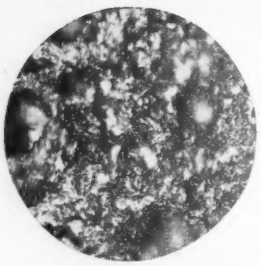


Fig. 1. Alloy Steel 30X pickled one hour in uninhibited acid bath. No trace of polishing marks or original polished surface are visible—the pits are so deep the bottoms are out of focus.

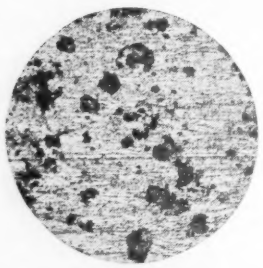


Fig. 2. Alloy Steel 30X pickled three hours in acid bath inhibited with Rodine No. 81. Pickled three times as long as in Fig. 1. Only a few shallow pits appear. Most of surface is unchanged—the polishing marks are still visible.

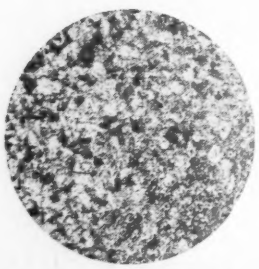


Fig. 3. Alloy Steel 30X pickled three hours in Rodine inhibited acid bath to which salt (NaCl) was added. The surface presents a uniform shiny crystalline structure — a good surface for drawing.

And Provide a Better Surface for Lubricating and Drawing

Metal waste is never justified and especially now when war production is requiring the major portion of the Nation's output.

RODINE remarkedly reduces the attack of the acid on the metal and provides a clean smooth surface. Compare the surface in figure 2 pickled with Rodine for three hours with that of figure 1 pickled in an uninhibited bath for only one hour.

The use of common rock salt along with the RODINE in a sulphuric acid bath further reduces the attack and provides a finely crystalline surface to hold lubricants as shown in figure 3.

RODINE in the pickle bath confines the acid action to its prime purpose—removal of scale—and thus minimizes acid attack on the clean metal thereby overcoming deep pitting and embrittlement.

There are types of RODINE suited to the varying pickling problems. The experience of ACP Technicians is at your service to recommend the Rodine and method of application best suited to your needs.

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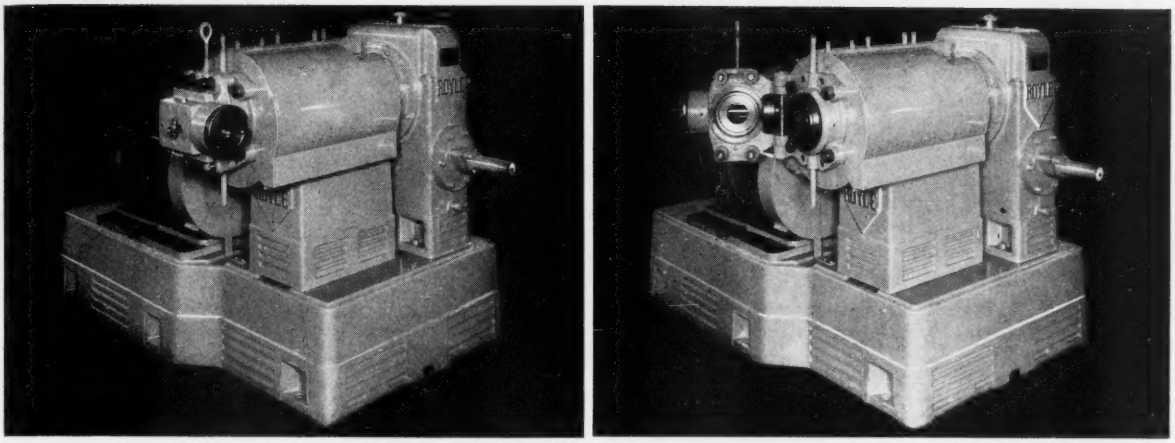

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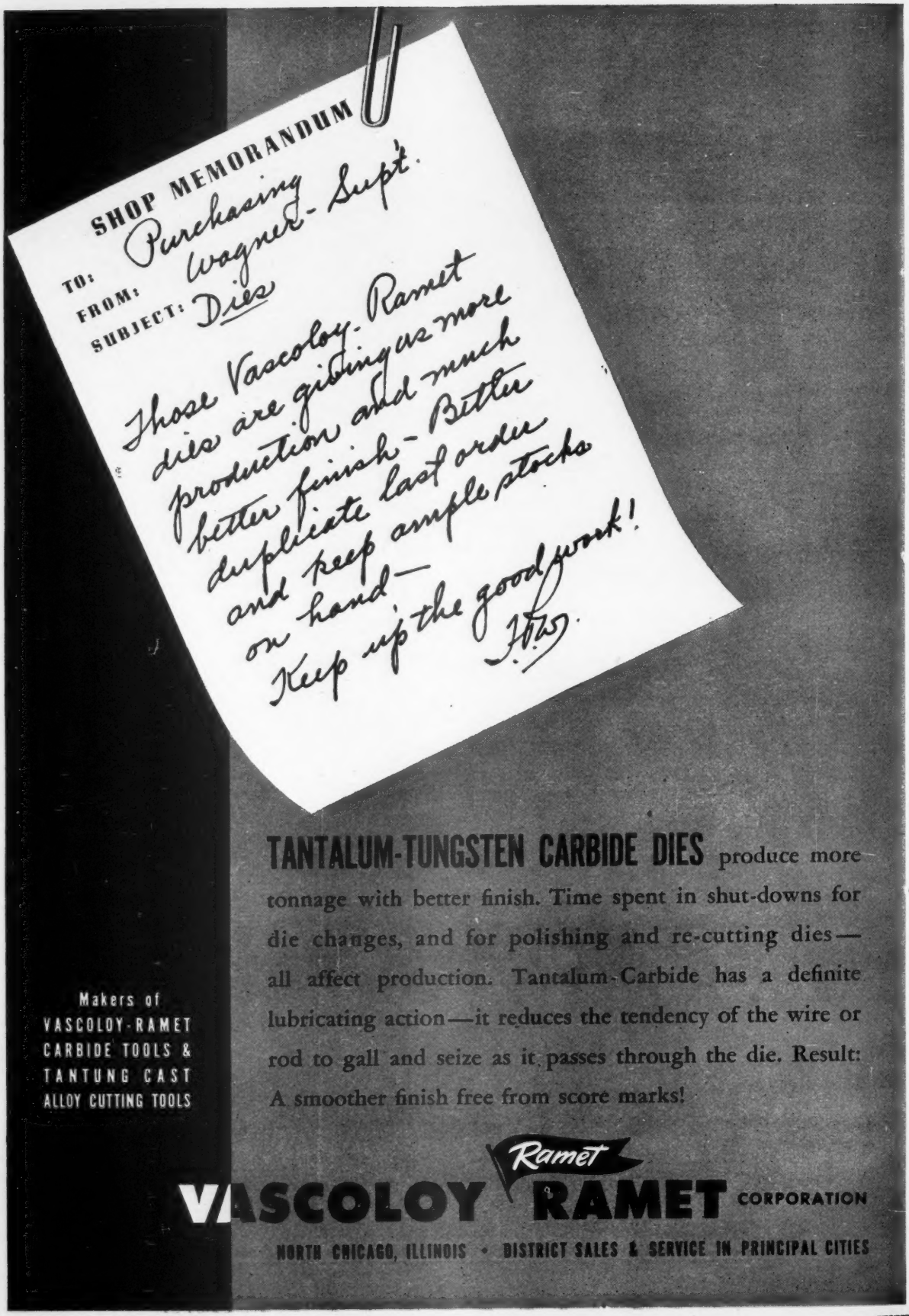
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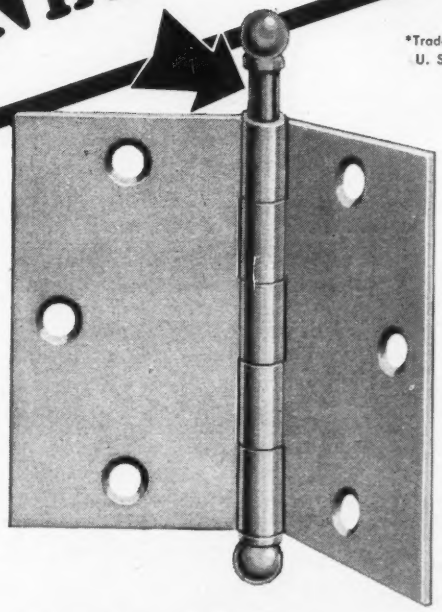

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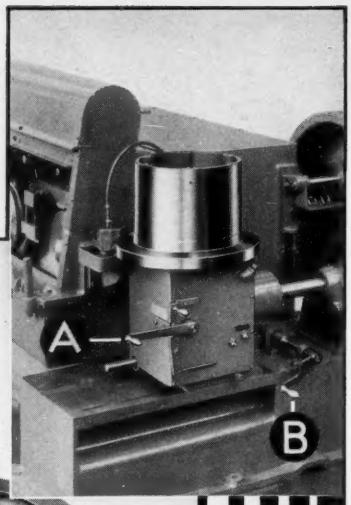

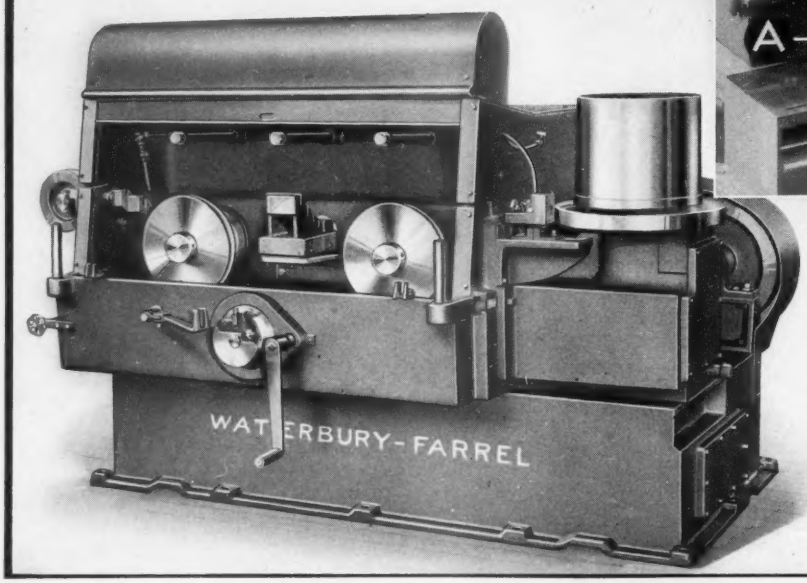

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WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 20 JANUARY, 1945 No. 1

Designated as

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A monthly publication devoted to the production of Wire, Rod and Strip.
Wire Products and Insulated Wire and Cable.
DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 20 JANUARY, 1945 No. 1

Carbon Steel for The Wire Industry

By A. M. Reeder
Metallurgical Engineer
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

THE MORDICA MEMORIAL LECTURE
— 1944 —

Introduction

MR. Chairman, Members of the Wire Association and Guests:

✦ ✦ ✦

IT has been with a deep feeling of responsibility that I have prepared this, the sixth **Mordica Memorial Lecture,** given to honor the memory of **John Mordica,** the first president of the Wire Association. I wish to thank the Board of Directors of the Association for the honor of being chosen to present this lecture in memory of the man who was not only the guiding light, in the founding of this association, but who started us on the path toward that fine mutual cooperation which exists in the wire industry today.

✦ ✦ ✦

WIRE, as one of the most diversified products of this age of steel, is unique in the number and variety of carbon steels which can be utilized in its production. This fact, coupled with the fact that the wire drawing process affords a means for attaining such a wide latitude in physical properties and finishes, is responsible for the infinite variety of products which can be fabricated from wire.

This Lecture was presented at the Annual Wire Association Convention held at Pittsburgh, Pa., October 16th-19th, 1944.

A. M. REEDER
Metallurgical Engineer
Jones & Laughlin Steel Corp.
Pittsburgh, Penna.
Mordica Memorial Lecturer—1944

MUCH has been written on the subject of the wire drawing die and the various operations involved in the production of wire from the hot rolled rod or bar. The important place which steel quality plays in wire production appears to have received much less consideration than it justly deserves. In view of the fact that the last decade has been so outstanding in the development of new and more critical applications for wire, necessitating a new high in steel quality, we wish to discuss herewith, some of the major improvements which the steel manufacturer has instituted to meet this quality demand.

✦ ✦ ✦

Historical

IT is a far cry, indeed, from the days of wrought iron wire to the steel wire age of today. However, wrought iron was destined to play a very important part in the early development of the wire industry. Centuries were to elapse before the dawn of the steel era and even up to the time of our Civil War, wrought iron continued to be the predominant available metal for drawing to wire. Most

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IN MEMORIAM

JOHN MORDICA
1873 - 1937

of this wrought iron was made by the puddling process, invented by Henry Cort about 1780. In the old puddling process, the iron charge was melted on a long hearth, lined with iron oxide, (shown in Figure 1).

✦ ✦ ✦

DURING the boil, the metal was stirred vigorously until the charge "came to nature" and reached the balling period. The heat was then tapped as a ball of pasty metal, which was compressed in some form of press where part of the slag was squeezed out, the rest remaining to form the so-called fiber on rolling. Strips of puddled iron were bound together and further worked down to more uniformly distribute the slag, the final quality depending on the amount of this work applied. The puddled iron constituted the base metal for all of the early wire for telegraph purposes, wire suspension bridges, cables, etc. The various qualities of wrought iron for telegraph wire, when considered in terms of electrical conductivity, were designated as B.B. (best-best) or E.B.B. (extra best-best) which terminology still exists although steel has long since been substituted for the wrought iron grades.

✦ ✦ ✦

DURING the wrought iron era, the principal source for carbon steels for the wire industry was the crucible process. Large quantities of wrought iron were used as the base metal in the manufacture of crucible steel. The chemistry of the process was quite simple, consisting primarily in eliminating the slag present in the wrought iron and the absorption of carbon, silicon and manganese. Figure 2 shows a diagramatic sketch of an old crucible plant layout.

✦ ✦ ✦

PROPER control of this process yielded the wire industry a high grade in the various carbon ranges, but the cost of production was too great to stimulate its application to the common grades of wire which were most important from a tonnage standpoint. One of the more important applications of Crucible steel during this period was in the production of rope wire, in various grades according to physical requirements, designated as Crucible grade, plow grade and improved plow grade. These designations persisted long after Crucible steel had been superseded by open hearth steel.

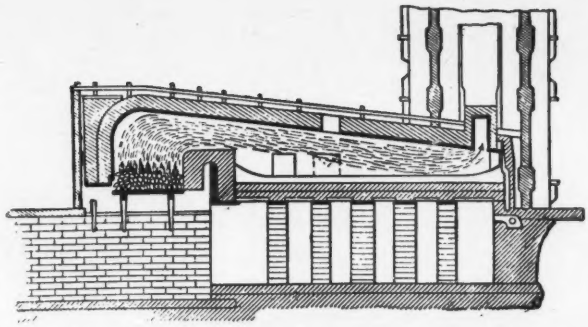

Figure 1. Sketch of old type puddling furnace. ✦ ✦ ✦

✦ ✦ ✦

THE rapid development of the United States during the last century created a need for large quantities of steel of the soft variety for the wire industry which would be available at a lower cost than wrought iron or Crucible steel. With the building of our railroads westward, there followed the demand for large quantities of telegraph wire. The settling of the rich agricultural lands of the midwest created the necessity for fence wire. At this opportune time, the Bessemer and a little later, the open hearth steelmaking process appeared on the horizon and simultaneously the continuous rod mill was developed. Thus the stage was set for our modern wire age. The progress in ferrous metallurgy briefly covered thus far, while embracing several hundred years in world history, represents but the foundation for the developments which have been made since the advent of the Bessemer and open hearth processes. The acid Bessemer process first made available for wire manufacture the desired tonnage of steel at a price sufficiently low to stimulate its use for fence, telegraph wire, strand and the innumerable wire items required by a resourceful and inventive people. The acid and basic open hearth processes followed closely on the heels of the Bessemer process and each found a place according to its ability for supplying a quality of steel that met the growing demand of the wire industry.

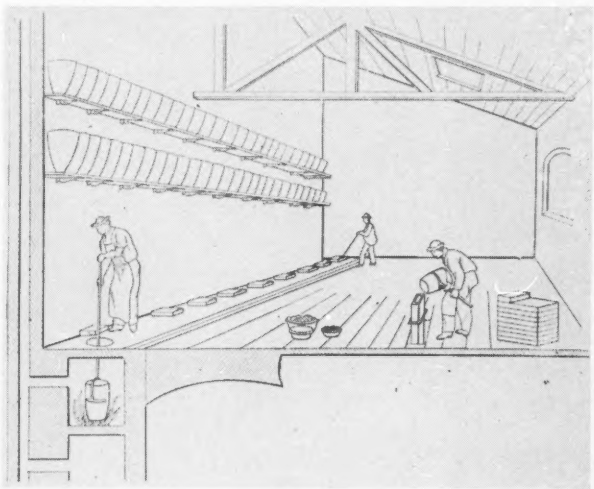

Figure 2. Sketch of layout of old Crucible plant. ✦ ✦ ✦

✦ ✦ ✦

THE rapid progress of the wire industry has been made possible through the great advances in both quality and quantity steel production which started with the introduction of these new steel making processes. The wire mills can be truly grateful for the continued improvements in steel quality which have made it possible for them to supply their trade with better quality wire at little extra cost. Such improvements are not just incidental, but almost invariably represent an investment in greater overhead costs which must be compensated for by increased yields of a more satisfactory product.

✦ ✦ ✦

Recent Improvements in Iron Quality

SINCE iron is the basic metal used in the manufacture of steel, its quality is of great importance to the steel maker. Iron of a quality most suitable for each

steel making process involved, has resulted from a closer control of the blast furnace operation and the raw materials which constitute the charge; namely, iron ore, coke and limestone. Outstanding has been the improvement in the quality of the coke used in iron production. Coal used for the production of high grade metallurgical coke is now selected on the basis of the following characteristics:

1. Uniformity.
2. Control of expansion properties.
3. Good carbonizing properties.
4. Low sulphur.
5. Low ash.

✦ ✦ ✦

TODAY, the major percentage of the coal for the production of blast furnace coke is subjected to a washing treatment which materially reduces the ash and sulphur content. Coal thus scientifically selected and subjected to a scrubbing treatment makes it possible to supply the blast furnace with a superior coke, resulting in a smoother running furnace and consequently more uniform and improved iron quality. Smooth blast furnace operation makes possible the production of iron with greater uniformity of analysis and temperature and does much to minimize the amount of unreduced oxides in the iron.

✦ ✦ ✦

SCIENTIFIC study of blast furnace operations and close investigation follow up between the iron and steel producing units, has resulted in the production of iron of a character and analysis most suitable for each particular steel making process involved. Typical iron analyses for Bessemer and open hearth steel production are shown in table A.

✦ ✦ ✦

THE chemistry of the acid steel making practices does not allow for much reduction of phosphorous, hence the necessity for markedly lower phosphorus iron than can be utilized in the basic open hearth.

✦ ✦ ✦

Developments in Bessemer Steel Manufacture

THE advent of Bessemer steel revolutionized the steel industry and along with it the wire industry as well. The wire mills now had available a raw material which was one fourth to one fifth the cost of either wrought iron or crucible steel. It was not long before continuous rod mills were rolling tens of thousands of tons of Bessemer rods for drawing to fence, telegraph, nail, wood screw, screen wire and a host of other essential wire grades. Continuous wire drawing machines were developed and drawing practices standardized on the basis of Bessemer steel application. A good example was in the production of fine wire for screen cloth, practically all of which was produced from Bessemer steel until the early nineteen thirties. The wood screw industry, which was in its heyday during the first quarter of the century, utilized Bessemer wire almost exclusively. This was an ideal application, in view of its desirable free-cutting qualities, as all wood screws were cut thread, shaved and slotted.

TABLE A

	C.	Mn.	P.	S.	Si.
Basic Open Hearth (Low Manganese) Iron	4.25%	0.50%	0.200%	0.030%	1.00%
Basic Open Hearth (High Manganese) Iron	4.25	2.00	0.200	0.030	1.00
Acid Bessemer Iron	4.25	0.50	0.085	0.035	1.25
Acid Open Hearth Iron	4.25	1.25	0.050	0.030	2.00

✦ ✦ ✦

THE Bessemer process still continues to be one of the most interesting methods of making steel. No extraneous fuels are used in the refining process and it is the only steelmaking method in which the charge must be liquid. The total refining period for 10 to 25-ton heats (blows) is from 10 to 20 minutes. The refining process, depicting the removal by oxidation of metalloids during the Bessemer blow is illustrated in the table (Figure 3), which is fairly representative of Bessemer iron with normal analysis.

IT had been known for many years that Bessemer steel exhibited a greater sensitivity to cold work than open hearth steel. This phenomenon was attributed chiefly to the higher phosphorous content inherent with Bessemer steel as a result of the acid Bessemer process. In the application of Bessemer rods for fine wire drawing, as in the case of screen wire, the standard practice was to draw the #5 rod (.218″) to about 14 gage (.076″) wire, which was pot annealed and then drawn to about 20 gage (.035″) where it was again annealed, followed by wet drawing to the final size (33 or 34 gage). With improvements in wire drawing technique in recent years, many attempts were made to eliminate the intermediate annealing treatment at the 14 gage stage but without success due to the excessive breakage. A mild basic open hearth steel, on the other hand, could be successfully drawn direct to 20 gage because of its greater capacity for cold work. However, it had been noted that some Bessemer heats exhibited a greater capacity for cold work than others even though there was no noticeable difference in the regular chemical analysis or ingot practice. Recent developments have pointed to the fact that such heats were very likely lower than normal in nitrogen and that the nitrogen-phosphorous ratio is closely associated with the sensitivity of the steel to cold work.

✦ ✦ ✦

THE recent development of photocell or so-called "flame control" for

REMOVAL OF METALLOIDS

Element	Initial Charge, Per Cent	Time of Blowing				
		2′0″	3′30″	6′0″	8′10″	10′0″
Carbon	4.30	3.90	3.75	2.10	0.60	0.03
Silicon	1.25	0.70	0.38	0.03	0.03	0.005
Manganese	0.40	0.10	0.04	0.03	0.01	0.01
Phosphorus	0.085	0.088	0.090	0.092	0 094	0.096
Sulphur	0.035	0.035	0.036	0.037	0.038	0.039

Figure 3. Table depicting removal of metalloids during the Bessemer blowing period. ✦ ✦ ✦

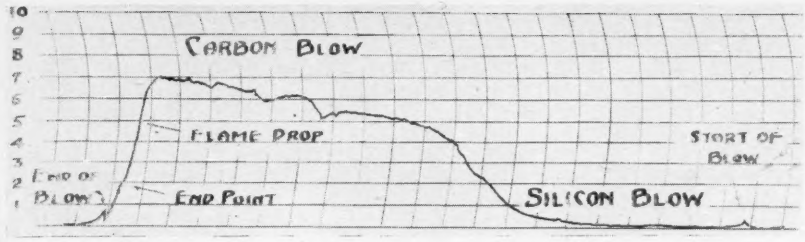

Figure 4. Typical recording of a Bessemer blow, obtained by the photo-electric control recorder.

Bessemer steel making has been an important aid in obtaining a more uniform and higher quality product. It allows for much closer control than is possible when the blower has only his eye to reveal the progress and end point of the blow. Figure 4 shows a typical photocell recording of a Bessemer blow.

✦ ✦ ✦

THE period of time from the end point until the vessel is turned upon its side and blowing has stopped has been called the afterblow. This afterblow is used as a measure of the degree of metal oxidation, and uniformity demands that it be controlled within narrow limits.

EXTENSIVE investigations of other methods for controlling the factors effecting the work hardening characteristics of Bessemer steel are under way, the results of which will undoubtedly be of considerable value to the wire industry. Many items for example which now require a sulphurized open hearth steel for balanced free machining and cold forming properties, may be produced more satisfactorily in the future from a scientifically controlled Bessemer steel application.

✦ ✦ ✦

Developments in Open Hearth Steel Manufacture

TODAY the **basic open hearth** is producing most of the steel for the wire industry. A considerable tonnage of acid open hearth steel is still used in the production of high tensile rope and bridge wire, but even here we note a gradual trend to the basic grade. There are two practical reasons for this change: first, the remarkable strides made during recent years in the scientific control of the basic open hearth process appear to have advanced the quality of basic steel to the high level of the acid grade. The second reason is based on the fact that the acid practice is not conducive to the reduction of phosphorus, and since our domestic ores are generally high in this constituent, it is natural that the basic open hearth process should take preference.

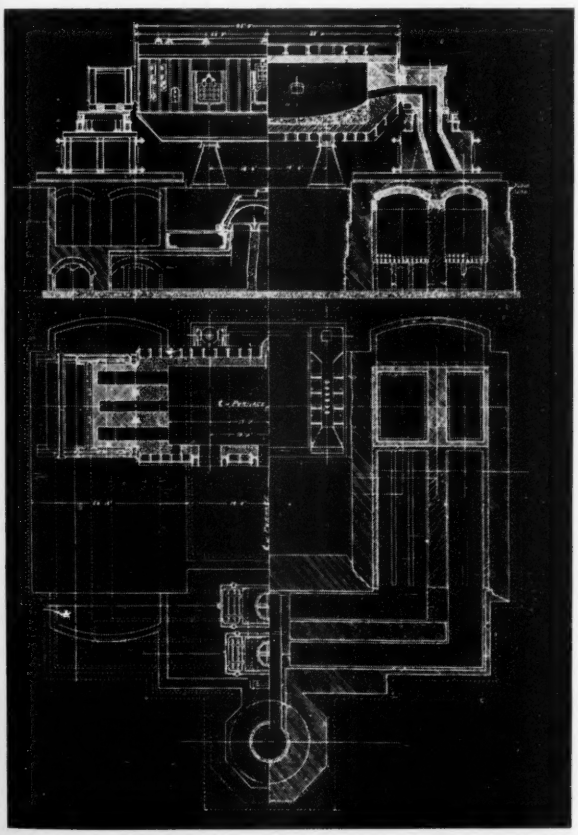

Figure 5. Diagramatic sketch of two views of tilting open hearth furnace.

✦ ✦ ✦

THE larger portion of basic open hearth steel is produced by the scrap process where the principal constituents of the furnace charge consists of proper proportions of steel scrap, iron and limestone. The average time from charge to tap is approximately twelve hours for a 150-ton heat. The duplex process should also be mentioned here, as it accounts for a considerable tonnage of basic open hearth steel now being produced for the wire mills. The tilting furnace is in general use for the manufacture of duplex steel, diagramatic sketch of which is shown in Figure 5.

✦ ✦ ✦

IN the duplex process the major portion of the metallic charge consists of Bessemer blown metal transferred in the molten condition to the open hearth furnace, the proportion of pig iron being limited to the amount required to properly refine the heat. The fact that no scrap is required, makes this process particularly desirable when a shortage exists in scrap as has been the case during the past few years.

✦ ✦ ✦

LET us now survey briefly some of the more important open hearth steel making factors which have such a direct bearing on wire quality. Ranking high in the list of improvements is the scientific control of the slag, the chief agency for the purification of the metal bath. While open hearth operators have long realized that the characteristics and condition of the slag were closely related to the operation of the furnace and the quality of the steel, it was not until very recent years that the technical staffs of the leading steel companies concentrated on the problem of slag-metal relationship from the viewpoint of scientific control. The character of a slag during the refining period depends upon the composition, temperature and fluidity or viscosity. Slag control starts with the charging of the open hearth furnace. The composition, physical characteristics and quantities of the metals and slag-forming materials or fluxes, charged into the furnace, are regu-

lated so as to give when melted a slag with properties best suited for the efficient refining of the metal. Chemical analysis and visual examinations are made of standard pancake slag samples. The slag samples are classified according to color, surface design, lustre, density and structure, thus rapidly supplying to a surprising degree of accuracy, information as to chemical relationship such as lime-silico ratio or basicity and iron oxide content.

✦ ✦ ✦

AN important aid to proper slag control in the open hearth furnace is the control of temperatures. A great deal of scientific research has been conducted on this subject in recent years and a control developed which has been very helpful in the general improvement of steel quality. Accurate information on the temperature of the bath during the refining period is essential in obtaining and maintaining conditions such as will assure the highest degree of purification as well as the required conditions for proper teeming in the molds. Both radiation and optical pyrometers are being employed in this connection and in recent years various types of high temperature measuring thermo-couples have furnished valuable data particularly on temperatures of furnace roof and walls.

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Developments in Ingot Practices

THE chemical analysis and state of oxidation of the liquid steel tapped from the melting furnace is determined by the desired ingot mold practices and the ultimate application. Ingot practice is determined by the extent to which deoxidation has been effected before the steel is teemed into the molds. In order of decreasing oxygen content, the typical mold practices may be described as rimmed, capped, semi-killed and killed. Deoxidation is regulated in both the furnace and ladle according to predetermined schedules for the various grades produced.

✦ ✦ ✦

IN the production of a rimmed ingot, such as depicted in Figure 6-A, the desired action requires a relatively high oxygen content so that a rapid gas evolution or effervescence will occur in the mold. Sluggish ac-

✦

Fig. 6 B. CHEMICAL ANALYSIS of drillings taken at the numbered locations (see fig. 6A)

✦

✦

✦

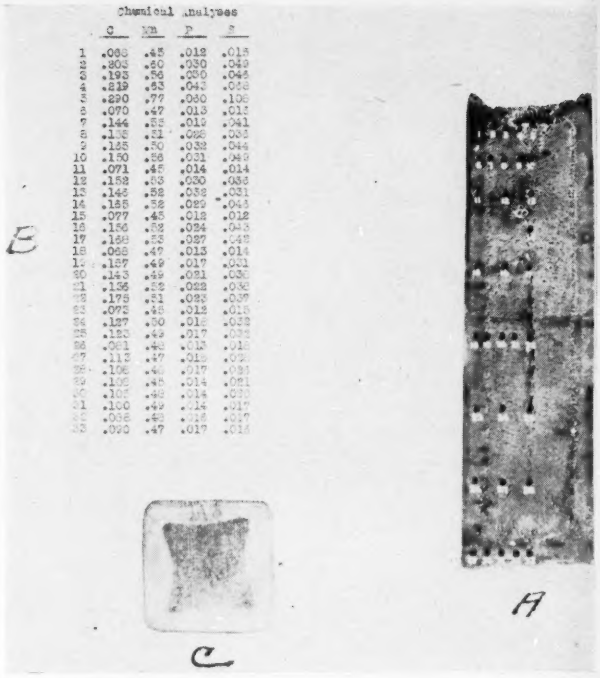

Fig. 6A. Longitudinally Split Rimmed Ingot. Note locations of drillings for Chemical Checks. ✦ ✦ ✦ ✦ ✦

Fig. 6C. Deep etched cross section of 1¾" billet, rolled from a Rimmed Ingot of heat from which split ingot (Fig. 6A) was taken. ✦ ✦

✦ ✦ ✦

Fig. 7B. CHEMICAL ANALYSIS of drillings taken at the numbered locations. (see fig. 7A)

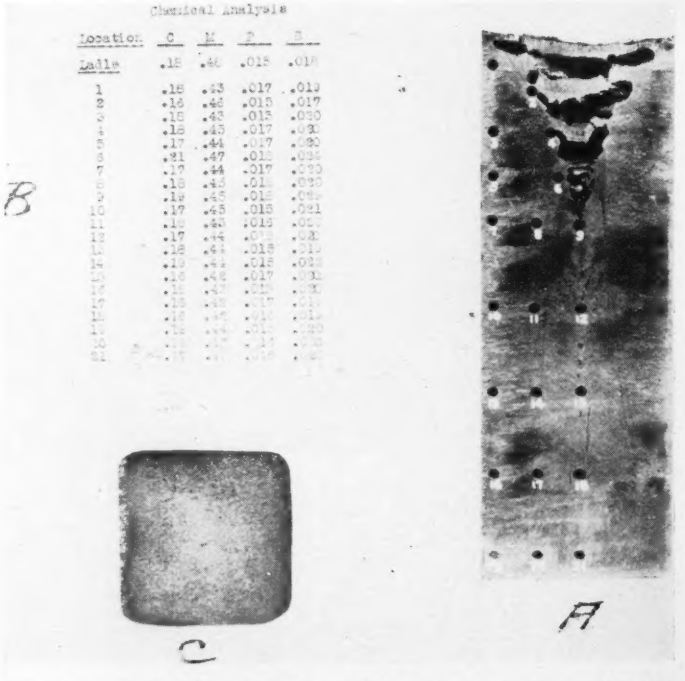

Fig. 7A. Longitudinally split Killed Ingot. Note locations of drillings for Chemical Checks. ✦ ✦ ✦ ✦ ✦ ✦

Fig. 7C. Deep etched cross section of 1¾" billet, rolled from a Killed Ingot of heat from which split ingot (Fig. 7A) was taken. ✦ ✦ ✦

tion in the mold results from the use of an excessive quantity of deoxidizers such as silicon or aluminum, or may be caused by improper teeming temperature. Such an ingot may be spongy and will be inferior in surface quality.

✦ ✦ ✦

CARBON, in increasing amounts, tends to decrease the gas evolution and it is difficult to obtain a satisfactory rimmed steel when this element is over .20 per cent unless the evolution of gas is aided by some mechanical means such as jarring. Sulphur and manganese in increasing amounts also retard the rimming action or in other words, have a "killing" effect on the steel.

✦ ✦ ✦

RIMMED steel can invariably be identified by a deep etch test of the cross sectional area of billet or wire. The rim metal being relatively pure and low in carbon, etches quite slowly as compared to the core which contains most of the segregating elements such as carbon, sulphur and phosphorous. Because of the effervescence during solidification, rimmed steel is more susceptible to positive segregation of such elements as carbon, phosphorus and sulphur than is the case with a killed steel of similar analysis. Therefore, the check analysis throughout an ingot or heat of rimmed steel will necessarily show wider variations than killed steel, or even capped steel. For this reason, the variations in check analysis allowed on the American Iron and Steel Institute grades are applicable only for killed steel and inapplicable for rimmed steel for elements other than manganese and copper.

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KILLED steels in contrast to rimmed steels are treated with relatively large amounts of deoxidizing agents such as silicon or aluminus, in the furnace or ladle, in order to eliminate the excess gas or render it inactive. Solidification proceeds quietly but somewhat more rapidly than in the case of a rimming steel, producing an ingot of greater homogeneity (see Figure 7), that is, less segregation of the elements, carbon phosphorous and sulphur, but with a greater tendency for piping in the upper central shrinkage area of the ingot.

✦ ✦ ✦

STEELS with carbon higher than .20 per cent are considered as "natural" killed steels since in their molten state they have less solvent power for gas and hence will have little or no tendency to effervesce while freezing, particularly if they also contain any appreciable quantities of silicon, manganese or sulphur.

✦ ✦ ✦

CAPPED steels are also used to some extent in the wire industry for certain low carbon applications. Mechanically capped steel is produced by teeming into a bottle top mold, then covering the ingot mold with a close fitting metal cap. Silicon capped steel is produced similarly except that capping is effected by the addition of a deoxidizer such as powdered ferro-silicon; in the top few inches of the ingot. By preventing the boiling action, the steel will freeze with less tendency toward positive segregation and the billet or wire will show a more homogeneous cross sectional structure when etched.

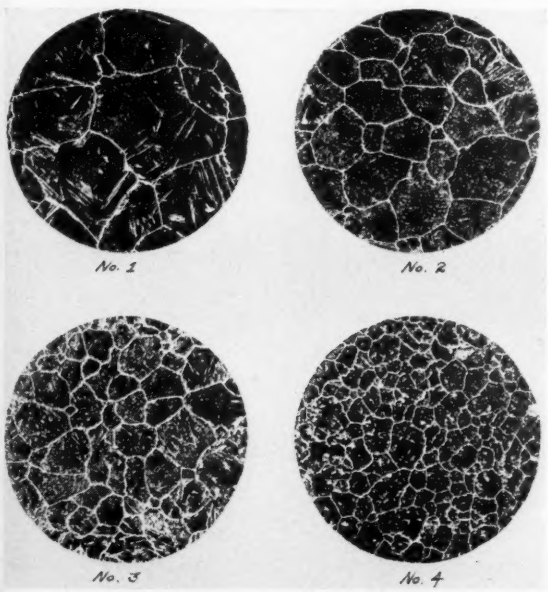

Figure 8. Depicting grain sizes 1 to 4 inclusive (A.S.T.M. rating).

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OF the three types of steel described above, according to mold practice, rimmed steel might be classified as most ideal for wire drawing, particularly in continuous drafting to the finer gages. This is probably due first to the somewhat higher order of ductility, and lower order of sensitivity to cold work exhibited by the rimmed grade. Second, to the superior hot rolling characteristics of this grade and resultant surface quality. The same characteristics make rimmed steel especially desirable for cold heading and cold forming operations. Large tonnages are also used in the manufacture of arc-welding electrodes primarily because of its comparative freedom from oxides of silicon or aluminum.

✦ ✦ ✦

THERE are various wire applications for low carbon steel where the killed steel is preferable to either the rimmed or capped grades. A good example is specialized galvanized wire, produced by the hot dip process. The zinc coating tends to show somewhat better adherence on the killed steel and this is even more noticeable if the steel is silicon killed. The presence of a differential core and rim pattern may cause rimmed steel to be an undesirable application, particularly on some plated parts. Killed or capped steels may be considered more desirable for cut-threading, whereas rimmed steel is preferable for roll threading.

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Austenitic Grain Size Control

ANY discussion of killed steels would be incomplete without reference to Austenitic grain size control. This subject covers one of the major developments of the steel industry during the last decade. Numerous wire items have been materially improved through scientific control of Austenitic grain size. This refers particularly to items which, after heat treatment, must exhibit maximum toughness and minimum distortion, inherent strain, or tendency to quench crack. We refer to products manufactured from wire such as bearing balls, lock washers, special types of bolts and screw, special cold forgings, etc. When any carbon or

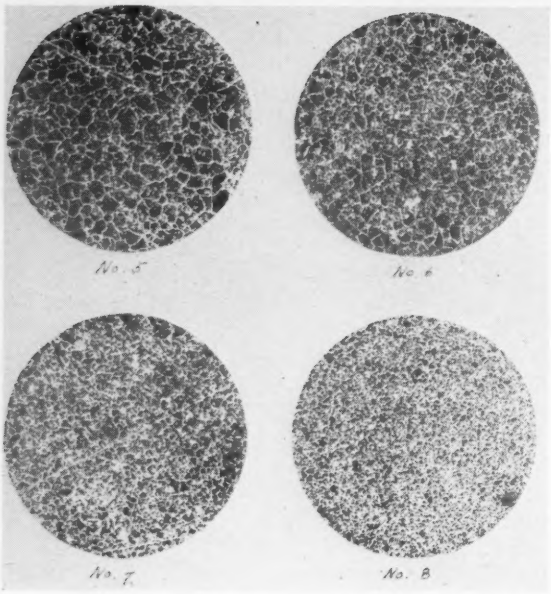

Figure 9. Depicting grain sizes 5 to 8 inclusive (A.S.T.M. rating).

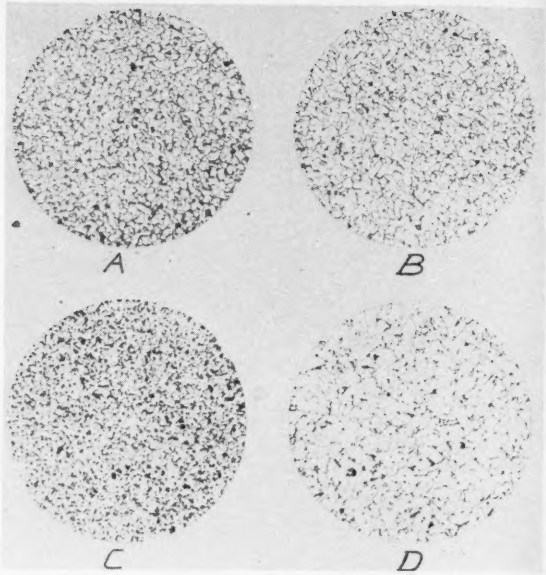

Figure 10.—A. Fine grained low carbon steel (as rolled rod).
B. Course grained, low carbon steel (as rolled rod).
C. Fine grained, low carbon steel (Normalized at 1700°F.)
D. Coarse grained, low carbon steel " " "

low-alloy steel is heated above its so-called critical temperature (Ac3), austenite grains form, the rate of growth of which will depend not only on time and temperature above the A3 point, but especially on the presence or absence in the steel of any constituents which may retard austenitic grain growth.

✦ ✦ ✦

THE general practice employed in producing fine grained steel is to add aluminum in the ladle, somewhat in excess of the amount which may be required to complete deoxidation. Capped and rimmed steels are considered coarse grain steels. Silicon killed and even aluminum killed steels are coarse grained unless sufficient additional aluminum has been added to inhibit austenitic growth to the extent which will show the steel to be fine grained when subjected to a standard test. This test consists of carburizing for a definite time—temperature interval and examining the resultant grain structure under the microscope at 100 magnification.

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THE grain size is classified in accordance with a Standard American Society for Testing Material Chart, and steel is designated as "coarse grained" when the structure falls within the limits depicted by photomicrographs, one to four inclusive of the above mentioned specifications (see Figure 8), and "fine grained" when the structure falls within the limits depicted by photomicrographs five toeight inclusive (see Fig. 10).

✦ ✦ ✦

THE grain structure is considered satisfactory if 70 per cent is within the specified grain size limits. Quite frequently the term "grain size" is used to refer to the "as rolled" grain instead of austenitic grain size. In this connection, we show in Figure 10, photomicrographs of the "as rolled" structure of both coarse and fine grained steels. These were taken from rods,—finish rolling temperatures approximately 1700°F.

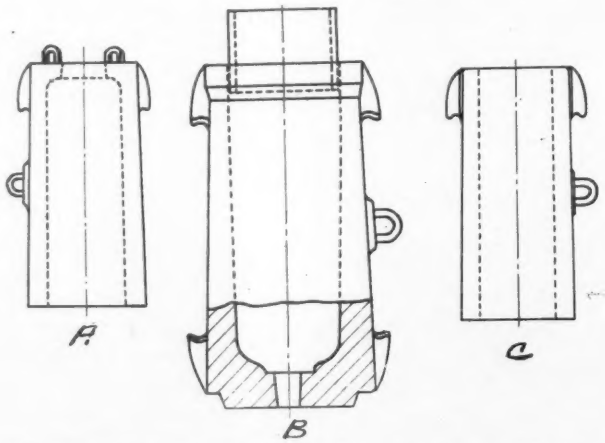

Figure 11.—A. Bottle top mold (for producing mechanically capped ingot(s).
B. Big end up refractory top mold.
C. Big end down, open top mold.

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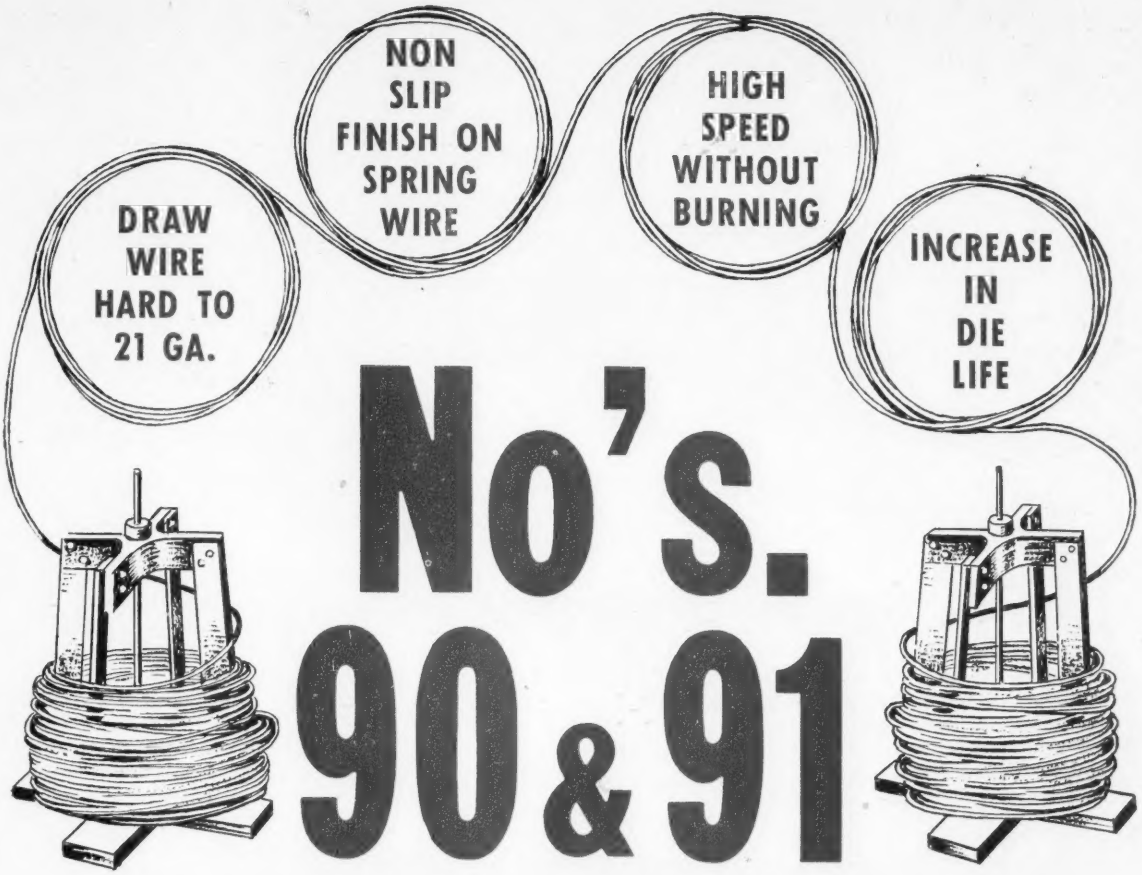
Importance of Proper Ingot Mold Practice

TO achieve the desired results as to quality and yield during solidification of the steel in the ingot molds, special attention must be taken to apply the proper type of mold. Killed steels freeze with shrinkage cavities or pipe in the upper portion of the ingot. Constituents in the steel having lower freezing points tend to be pushed to the central upper portion of the ingot as freezing progresses inward. It was almost universal practice until recent years to employ a so-called big end down, open top mold for the production of practically all steel for the wire mills. While this general type of mold is applicable in the casting of rimmed steels because of piping and segregation, necessitating the cropping of a considerable percentage of the upper portion of the ingot to assure sound steel.



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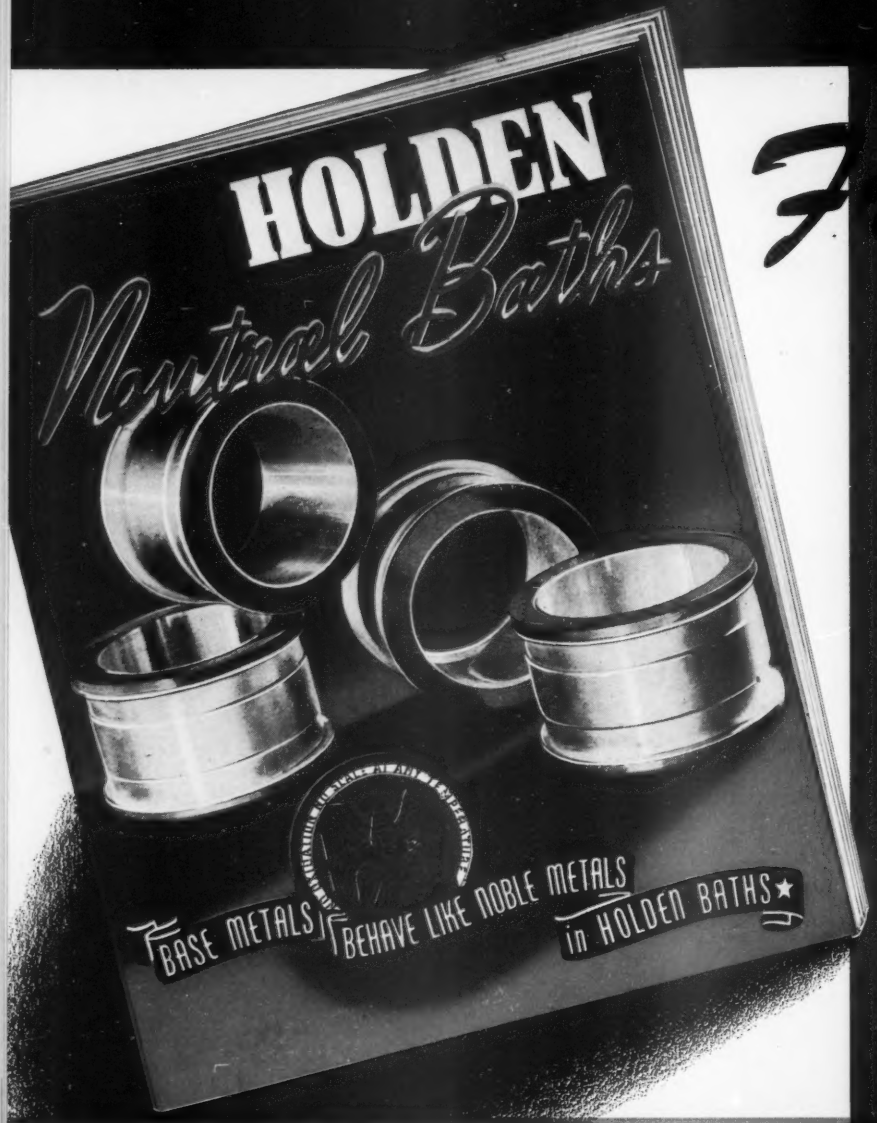

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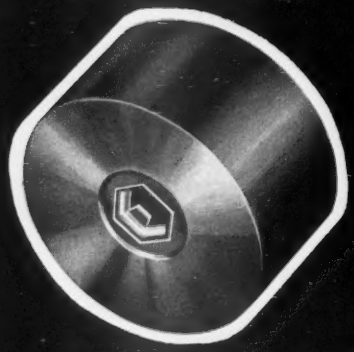

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As a result of a great deal of experimentation with molds of various designs by the steel industry, a practice has been developed whereby killed steels solidify in the mold with the formation of less pipe or segregated area, thus improving both quality and yield. The most ideal type of mold at present appears to be the big end up type with refractory lined hot top. However, a large tonnage of high quality steel is still being cast regularly in properly designed big end down molds fitted with refractory hot tops. Figure 11 shows sketches of typical big end down, open top and bottle top molds; also a big end up refractory top mold.

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ANY discussion of mold practice would be incomplete without reference to mold conditioning. Most modern steel mills have in recent years materially improved their facilities for properly handling such reconditioning. The importance of proper mold preparation cannot be overemphasized in its desirable effect on the surface quality of the finished rod or wire. The physical condition of the interior wall surface of the mold is of vital importance, and in all cases, should be clean and free from cracks and rough corners. Mold temperature at teeming, must be within certain limits.

✦ ✦ ✦

EXHAUSTIVE investigations have been conducted to determine the most desirable mold wash to apply and the proper procedure for applying same. Tar of the right grade might be mentioned as one of the most popular mold washes used. When correctly applied, a bright, hard, even coating is formed which protects the mold surface and materially improves the surface quality of the ingot. Because surface quality plays such a vital role in the production of wire, every operation from casting the steel to heating, rolling and inspection, is performed with a prime purpose of delivering to the wire mill a product as free from harmful surface defects as possible.

Importance of Proper Heating and Rolling Practices

EXPERIENCE has proven the value of proper heating facilities in the rolling mills and close coordination between temperature control and rolling procedure for each grade of steel. The rolling characteristics and subsequent surface quality of any grade of steel depend to a large degree on the ability of the surface layers of metal to stretch or elongate without rupture. Added sulphur steels such as open hearth or Bessemer screw grades are examples of steels with poor rolling characteristics because the steel is "red short", that is, may be easily ruptured when subjected to hot working. Proper heating for hot rolling of such steel has proven to be very beneficial. The modern soaking pit for controlled ingot heating is a furnace of the best in engineering designs. Automatic temperature controls prevent overheating or burning, and attention to heating atmospheres helps in reducing the degree of decarborization.

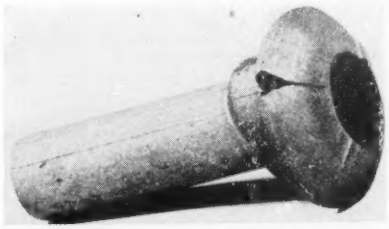

Figure 12. Cold headed bolt blank showing split head defect, resulting from longitudinal surface imperfection.

THE precautions that must be exercised in rolling the ingot, bloom or billet are just as essential to the attainment of surface quality as is proper heating, mold practice or even steel making. The rolling characteristics of each steel grade must be considered in reducing the ingot or bloom to the desired section. Adequate consideration is today given by the roll designer to prevention of both "mechanical" and "steel" rolling defects. The rolling mill personnel are thoroughly acquainted with the necessity for keeping overfills, guide scratches off-section, etc., to a minimum. On such items as special requirement quality cold heading wire for example, twist tests are usually made on rod, at the rod mill, to reveal surface defects which would affect its suitability for the cold heading application involved. A typical surface defect and its harmful effect is illustrated in Figure 12.

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IT is general practice to remove harmful defects from the billet surface by chipping or grinding. Chipping may be done with a pneumatic chisel or with a torch which removes the surface metal and defect by fusion. A recent innovation is the application of hot scarfing during the rolling of the bloom or billet especially on grades which require exceptional surface quality. The equipment for hot scarfing is placed in the roll train and as the hot bloom or billet moves along, surface metal is fused off to a depth of approximately 3/64", thus taking with it the surface defects of equal depth. In the final analysis, the degree of surface quality required depends on the ultimate processing requirements as well as the demands of the finished product, and it should never be forgotten that special demands for surface quality are generally fulfilled only by increased production costs.

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Conclusion

The developments in steel manufacture as pointed out in this paper have done much to advance the wire industry to its present high level. There is every reason to believe that as a result of the close cooperation that has developed between the research, metallurgical and operating departments, further important advances in steel making practices will be forthcoming in even greater numbers. As an illustration of such developments, it may be anticipated that spectroscopic analysis will augment to a considerable degree the present chemical analysis program of the steel mill. Furthermore, some new and startling innovations in steel and wire manufacture may safely be predicted through the relatively new science of electronics. It would be well to keep abreast of practical developments in the continuous casting of steel billets and it might not be too visionary to predict that a continuous cast rod, with its many possibilities for quality superiority over the present hot rolled rod, will one day be available to the wire mills.

✦ ✦ ✦

A truly great future lies ahead for the wire industry, but it will be a future dependent to an important degree on the technological developments of the steel industry.

ALL members of the Wire Association are cordially invited to submit technical papers either for publication in "WIRE & WIRE PRODUCTS" during the year or for presentation before the Annual Wire Association Convention.

✦ ✦ ✦

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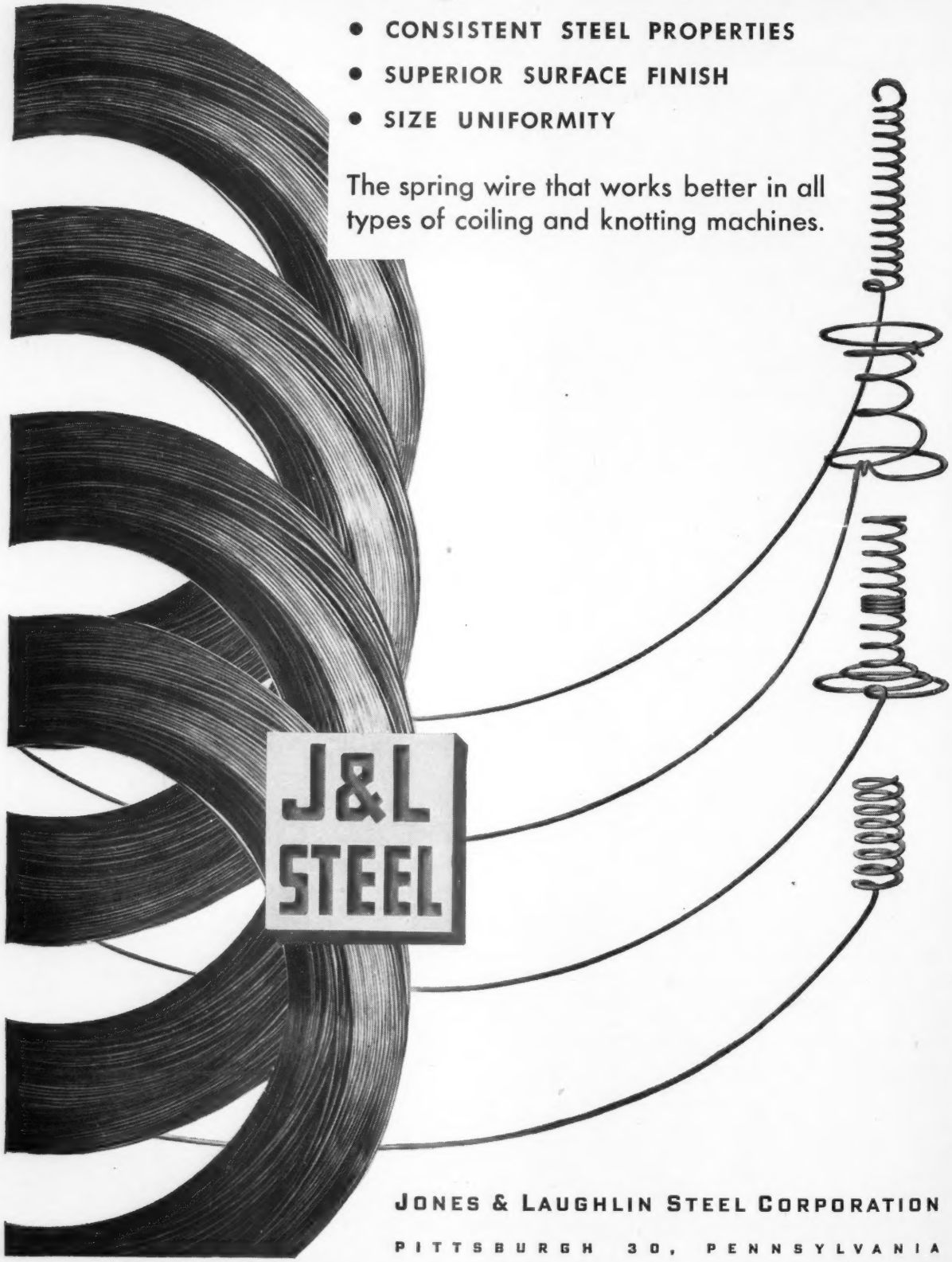

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Carbide Die Applications

By A. R. Zapp
Manager, Firthaloy Division
Firth-Sterling Steel Co., McKeesport, Pa.

A paper outlining the development and application of tungsten carbide dies for nail mills and for cold heading operations. This paper was presented at the Annual Convention of The Wire Association, Pittsburgh, Pa., October 18th, 1944. ✦ ✦

IN a previous article we discussed the history and growth of Tungsten carbide dies and their application to the drawing of wire. After establishing these dies in the wire mills and looking around for additional applications, we soon found the need for wear resisting applications and the larger field of application on wire products. It was apparent at once that some of these applications required tough shock-resisting grades. Developments were carried out first in the nail industry and closely after in the cold-heading industry. A great deal of imagination was required in visualizing what could be done with a material at that time considered brittle and not applicable to shock jobs. Experiments were conducted in the face of predictions of failure from all sides.

✦ ✦ ✦

SEVEN years ago, the superintendent of a nail mill wondered, in view of the success they had had with sintered carbide in wire-drawing dies, whether it would be applicable to nail dies. At the price nails were selling at the time, the mill was losing money on the entire nail-mill operation. Anything that could be done to cut down the amount of loss would be of great help to overall mill costs.

✦ ✦ ✦

WE then put into operation the first carbide nail die, which was very crudely manufactured and barbed. We obtained about four hours' run before the carbide split. We tried quite a few additional dies, with varied success. The final gripper die we put into operation, however, ran about 176 hours before it chipped and cracked.

✦ ✦ ✦

AT that time we decided that the application had possible merits, but that the proper grade of carbide was not available for the barbs to withstand the repeated gripping loads and at the same time hold up under the hammer blows. With existing grades the barbs were found to chip and crumble and the carbide flaked under the head and from this it was deducted that the grade was too brittle and that a tougher grade had to be developed.

✦ ✦ ✦

FOR approximately a year we concentrated on developing a grade of carbide that would more nearly meet the then unheard-of requirements that a carbide gripper die would have to meet. These experiments led to the development of our tough grades which proved so suitable for the manufacture of nails and also at the same time opened the large field of cold-heading of bolts, rivets, machine screws and related products which we will discuss later.

A. R. ZAPP
Manager, Firthaloy Division
Firth-Sterling Steel Company,
McKeesport, Penna.

✦ ✦ ✦

WITH the new grade, four sets of dies were tried. Three sets failed very early but the fourth set ran 400 hours before cracking. This production was outstanding and proved that a suitable grade was the first prerequisite and that other factors had to be studied to determine what caused failure. Consequently twelve more sets with this grade were tested. Six sets were run simultaneously with varied results. One set ran 800 hours; two between 300 and 400 hours; and the rest failed again very early. Subsequent runs on the remaining sets varied also, although one set ran 1500 hours before the barbs crumbled and the die cracked.

✦ ✦ ✦

AFTER intensive study of all these results, we concluded that we were definitely on the right track in our carbide, in view of the fact that the occasional die produced more than enough hours to pay out as against the cost of steel dies. In addition, the continuity of operation showed conclusively the hours obtained from longer runs were very profitable to the nail mills from a cost standpoint.

✦ ✦ ✦

OBSERVING that a few carbide dies operated over a long, continuous period, while the others did not, we decided that the trouble might be due to faulty operating conditions.

✦ ✦ ✦

WE then installed other sets of dies and had a service engineer with them constantly. After a series of runs, our digest of results showed that the long runs had been made with dies used on new die blocks. On the other hand, dies that gave the poorest results and failed largely on account of chipping, had been used

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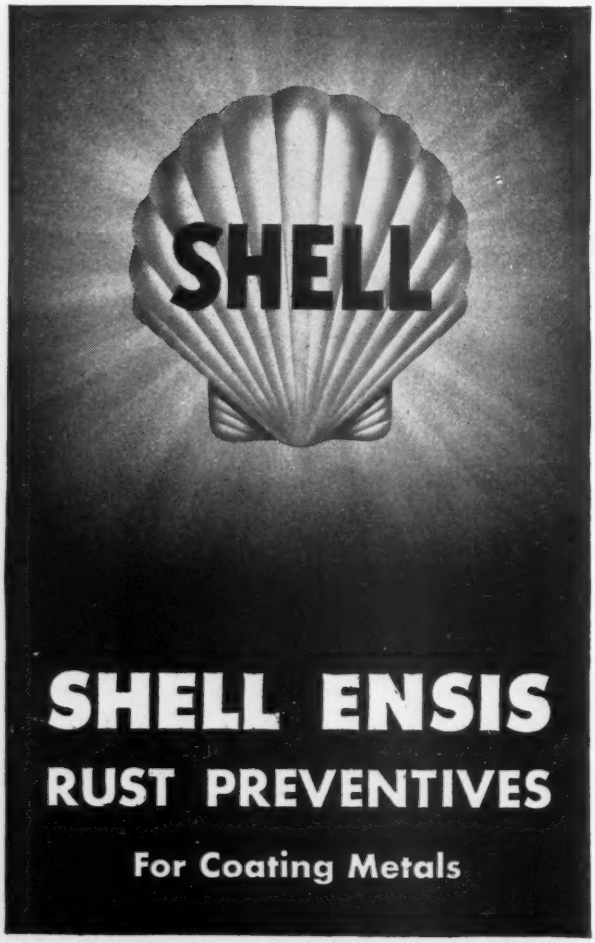


FOR YEARS AMERICAN INDUSTRY has paid tribute to demon rust to the tune of $1,000,000,000 a year. Rusting of lubricated surfaces has been "put up with" as a necessary evil.

Shell scientists and engineers, working with steam turbine manufacturers, did the "impossible". . . developed a rust-preventive turbine oil.

Using the wealth of knowledge gained by developing and perfecting this oil, Shell's Research Laboratories then focused their efforts on developing a similar line of rust-preventive oils for general industrial purposes. The result is the new Shell Tellus Oils for machine lubrication and the new Shell Ensis Rust Preventives for coating metals.

The new Shell Tellus Oils are not designed to *remove* rust. They will not eliminate all existing rusting conditions that may be present in your machines. But where moisture is a factor, the new Shell Tellus Oils, because of the special rust-inhibiting qualities built into them, afford unequaled protection against the formation of rust . . . and without the sacrifice of other valuable

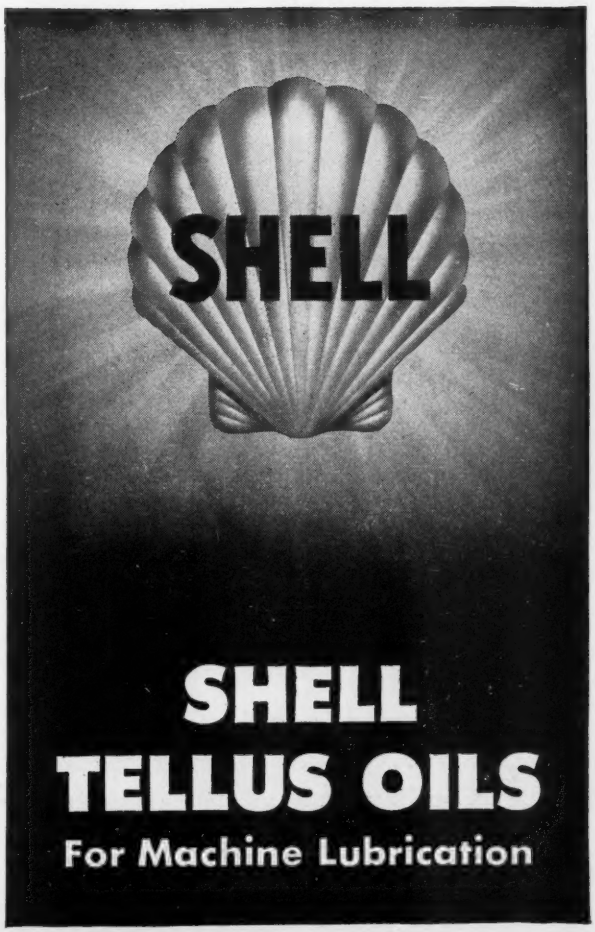
# of industrial products to

characteristics. They form a protective film that coats the metal, making it highly resistant to water and moisture. Shell Tellus Oils also have superior oxidation stability.

The new Shell Ensis Rust Preventives cover a complete line of oils, coatings and compounds. They are available in a number of grades, designed to give protection against the dangers of exposure, which range from the extreme effects of rain and snow during outdoor storage, to the mild humidity conditions encountered in the factory between machining operations. The protective coatings formed by Shell Ensis Rust Preventives graduate from the extremely thin, transparent oil films that need not be removed, to the heavy, abrasion-resistant coatings which will withstand severe weathering conditions over long periods of time.

* * *

Call in the Shell man now! After a thorough study of your operation he will recommend the Rust-Preventive Product best suited to your specific conditions. Write, wire or phone Shell Oil Co., Inc., 50 West 50th Street, New York 20, N. Y., or 100 Bush Street, San Francisco 6, Calif.



on worn blocks that were rounded and grooved, allowing considerable play and rocking while the nails were being headed. This caused considerable chipping of the carbide under the head.

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WHEN we found that the chipping under the head was caused by wear of the hardened wire guide button in the die-block, and also by wear on the dovetail and on the bottom of the ordinary die holder, we corrected this by inserting hardened plates and gibs, Fig. 1, which could be removed and reground parallel after wearing.

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WE then tried a series of dies on these new blocks and found that the results were practically uniform, largely through eliminating chipping. Even when chipping was overcome, failure through splitting of the nib continued to occur. Upon investigation, splitting was shown to be caused by the operators' pinching-up on the barbing dies during regular intervals on each shift. Pinching was common practice in order to prevent the wire from slipping whenever the barbs in the steel gripper dies wore, but when applied to carbide grippers it caused the nib to split because of the wedging action of the wire; in addition, an undesirable flash on the nail resulted. Our course of education in this mill taught the operators not to pinch-up on the carbide dies. In some instances, it was found necessary to replace experienced operators with new men who did not have fixed ideas; this resulted in a more successful operation.

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THE writer wishes to thank Mr. Harry Patterson (at that time superintendent of American Steel & Wire Company) and Mr. Steve Tarby, foreman, for their perseverance and constructive cooperation in this important ground work that developed **Firthaloy** nail dies to the point of being commercially practicable.

AT this point of development, we realized we were well along with our research on the refinement and improvement of the carbide, and also that a great amount of additional work would have to be devoted to the mills themselves.

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IT was at this time that we also instituted our initial work on heading hammers, and about a year later began our first development of cutters. Hammers are now well along toward practical operation and are used quite extensively for heading common nails, cup heads, and checker heads. For the common nails we have developed a special grade which offers enough hardness so that the carbide will not crater, while on the other hand for cup and checker heads, we are using another grade which offers enough toughness against chipping of the cup point on the cup head hammers and the edges of the diamond shaped grooves for the checker heads. At the present time a considerable number of cup heads have run approximately 500 hours before being removed for redressing and well over 300 hours on the checker heads before re-dressing is required. Here again the grade of the nib is of major importance, different grades being required depending on whether hardness or toughness is required. We have also at the present time a considerable number of cutters in service, and although the results are very encouraging, we find that we are still encountering some difficulties because of restricted bumper area and lack of continuous operation. Many of these cutters have paid for themselves on machines that were watched very closely and shut down before the bundle of wire completely ran out, thereby eliminating the machines running without wire, a condition which causes the cutters to strike together with resulting failure of the cutting edges.

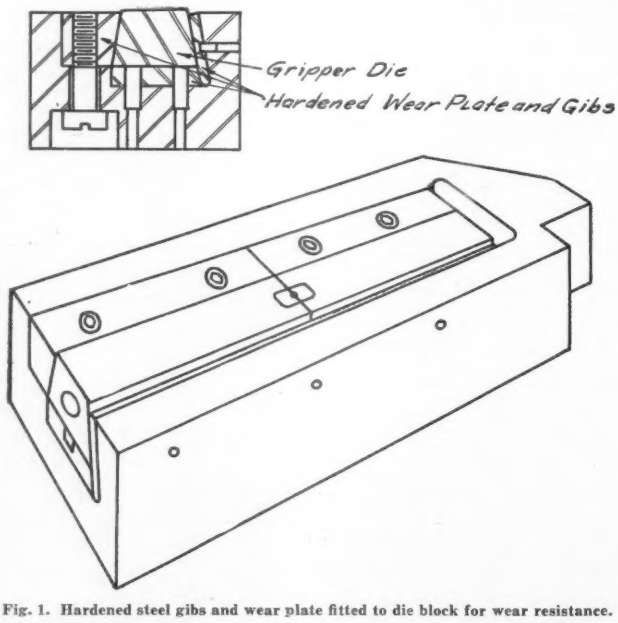

Fig. 1. Hardened steel gibs and wear plate fitted to die block for wear resistance.

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WE now began to realize that efficient nail mill operation would necessitate the furnishing of milled and brazed dies rather than finished dies because of the frequent changes and the prohibitive inventory required to meet the demands of the trade. Up to this time the method used to lap and groove the nibs for barbing proved too complicated and involved a considerable amount of time.

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CONSEQUENTLY, we developed machinery that could be installed in the users' plant to enable them to carry quantities of dies for each type of machine and finish or re-cut the dies to any size or quantity required. This would make it possible for the nail mill to operate almost any number of machines on one type of nail and change with comparative ease to making nails of either smaller or larger sizes without carrying an exorbitant inventory of finished dies.

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OUR die machinery for finishing nail dies went through the usual stages of evolution and suffered the average amount of growing pains. High-priced, original machines evolved into relatively simple, patented machines that can be installed in any plant at a reasonable cost.

AT this stage we installed a large quantity of Firthaloy gripper dies and hammers at Northwestern Steel and Wire Company, Sterling, Illinois. After careful observation by a Firthaloy die service representative who stayed almost a year at this mill, troublesome operational problems were corrected. Detailed performance data was taken and proved conclusively the practicability of both gripper dies and hammers for the nail mill.

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A debt of gratitude is due Mr. Paul Dillon of Northwestern Steel and Wire Company for his wholehearted cooperation and foresight at this important stage of carbide nail dies.

✦ ✦ ✦

IN conclusion, the carbide nail gripper die today is a successful application for common nails, box nails, cup-heads, tacks, and the wide variety of similar nail products having relatively thick heads. Gripper dies for roofing nails are not yet considered successful although certain runs are outstanding and indicate that under suitable conditions, now being investigated, this application also might attain the same successful status as gripper dies for the easy-to-head products listed above. Hammers and knives are well beyond the development stage although peculiarities in individual plants require close attention with regard to selection of grade and construction.

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IT is important to realize that carbide dies for the nail mill have been applied to machines designed for steel dies and tools and, as a result, many difficulties in adapting carbide have had to be overcome. One of these difficulties is that the dies and tools in many instances are not large enough to properly support the carbide insert and complete changes in the overall sizes of these parts and attendant changes in the holders are necessary before satisfactory performance is obtained. In certain cases the design of the machine is such that the desired changes can not always be made and as a result the design and performance of the carbide die or tool is inferior to what it should be. We believe that future nail machines shall be designed to suit carbide tooling since the latter is now an important feature of nail mill economy.

THE economies of carbide nail dies are today recognized in all progressive nail mills where the practicability of these dies has been proven. In this connection we feel that further economy will accrue through additional life of the carbide die and also through increased efficiency in affected nail mill operations whenever the following features are included in the nail mill set-up:

(1) Welding the wire bundles for the continuous feeding of wire into the header and prevention of die failure through eliminating the possibility of the machine running without wire.

(2) The use of a wire drawing attachment in conjunction with the header to maintain wire size and minimize tool and die wear by heading and cutting-off the wire before it has a chance to work-harden after drawing. It is well known that work-hardening takes place rapidly within the first three to six hours after drawing so by using the wire immediately after it is drawn in a wire-drawing attachment for the header, the wire will be in its most workable state. The necessary work-hardening for maintaining the required physicals will then take place after heading.

(3) Replace line shaft drives with individual motor drives. This will eliminate the pulsating load characteristic of line shaft drives and minimize wear on the nail machine bearings and other parts which necessitates frequent tool resetting and prevents obtaining maximum die life.

(4) Arrange the machines back to back along common aisles and use pans or buckets capable of holding an 8-hour production. These containers could be of suitable design for lift trucks to efficiently handle. Because of the large size of the buckets the nail machines should be mounted on platforms several feet above the aisle.

(5) Replacement parts for the headers should be made of alloy steels wherever strength and fatigue resistance is required in order to minimize machine failures that might cause smash-ups ruinous to the carbide dies.

(6) Install automatic devices that will stop the header quickly whenever wire breakage occurs in order to prevent damage to the dies running without wire.

WHILE the carbide nail die has only partially approached the universal acceptance of the carbide wire-drawing die, the latter is a far simpler application and has had the benefit of rapidly developed modern machines designed around the carbide die. Since contemplated changes in nail mills are much more carefully weighed on a cost scale, it is likely that improvements in the nail mill shall be more gradual but with each advance, we feel that the carbide nail die shall be depended on to increase production and reduce cost.

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Carbide Cold Heading Dies

THE present day practicability of Firthaloy cold heading dies is the result of painstaking developments that had their beginning about seven years ago. The end result is a tough grade of carbide for the nib early realized as a prerequisite for shock resistance, a suitable casing in which the nib is mounted, and the experience required to solve the many and varied problems of this field. This development work is of inestimable value in meeting production demands during these war years.

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IT should be pointed out here that this discussion is largely confined to heading dies of the solid die type, Fig. 2.

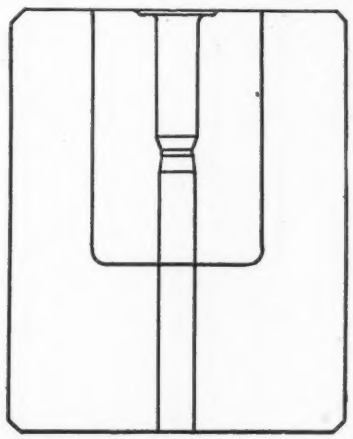

Fig. 2. Carbide heading and extruding die.

CARBIDE heading dies have rapidly approached the same degree of essentiality in the cold heading field that wire dies have in the wire drawing industry as a result of the

well known advantages of these dies.

These advantages are:

(1) Maximum continuous operation as a result of minimum downtime consumed largely in changing and setting up the equivalent number of steel dies.

(2) Maintenance of size within product limits over long production runs. This is particularly advantageous today in the production of close tolerance products such as aircraft bolts, rivets, etc. It is also apparent that size variations of the product as a result of die wear is progressive with minimum variation whereas for an equivalent number of steel dies there would be as many variations in size as of steel dies required.

(3) As a result of the superior finish obtained in carbide heading dies, it has been found that the centerless grinding of grip lengths of certain types of bolts requiring close tolerances has been eliminated in some instances.

(4) With increased production demands and the current shortage of skilled manpower in the users' die rooms, the carbide heading die with its long life has greatly alleviated the manpower situation not only because of the fewer number of dies required but also because the user has found a source of supply for heading dies and can use his time saved for other increased demands in his die room.

(5) Because of the better finish obtained with the carbide heading die, wear on related tooling, such as, thread-rolling dies and even heading punches, in some instances, has been minimized.

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CARBIDE heading dies are now commonly used in the manufacture of machine screws, wood screws, cap screws, hexagon, square and hollow head screws, aircraft bolts and rivets, whether monel, aluminum, copper, brass, or steel and a wide variety of specialties.

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THROUGHOUT the cold-heading industry it is well known today that the outstanding characteristic of carbide cold heading dies is long life before wearing oversize. In order not to speak in generalities the following production figures are cited. We do not wish to create the impression that these productions are to be considered as guarantees nor that they are obtainable without effort on the part of the user but that under proper conditions they are being obtained today in many plants.

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A heading die for counter-sunk aluminum rivets, 5/32 diameter, produced ninteen million pieces without having worn more than half its useful life when it had to be removed from the machine on account of premature failure resulting from an accident.

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A heading and extruding die for a 3/8" aircraft bolt of SAE4037 steel produced one million pieces at the time of receipt of a testimonial letter from the user who reported that it was still like new and from the small amount of wear that took place, indications were that it should produce at least another million pieces.

✦ ✦ ✦

FOR heading only a 3/8 inch cap screw of .18C steel, 6,000,000 pieces were obtained at the last report and the die was still in operation.

✦ ✦ ✦

FOR heading a #5 round head machine screw, 15,000,000 pieces.

✦ ✦ ✦

THESE are only a few of typical production reports indicating the practicability of carbide heading dies.

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UNTIL recently the use of carbide heading dies was limited largely to products having 5/16 diameter or smaller but we have carried out development work now on bolts up to 7/8 inch diameter with results that are indicative of the practicability of carbide heading dies for these larger sizes also. For example, 1,750,000 5/8-13 hex head bolts have been headed and extruded on a die the extrusion diameter of which has not yet worn .001 inches. The die is still in good condition and has produced as many as 30,000 bolts in a 12 hour shift. In heading only 3/4 inch and 7/8 inch hex-head bolts of both .18C and .38C steel production obtained to date on these recently installed dies is around 350,000 bolts each. The dies show no noticeable signs of wear at this point.

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FURTHER development work on Firthaloy carbide heading dies for large bolts is being carried out and a more complete picture should be available in the near future.

AS pointed out above a successful operation of carbide heading dies can only be carried out under proper conditions in the user's plant. The use of carbide heading dies is not the solution to overcoming difficulties attributable to improper operating conditions. Careful observance of the following factors is necessary for successful operation of carbide heading dies.

(1) Properly heat treated wire.

(2) Good coating on the wire.

(3) Well maintained heading machines with minimum wear in the bearings.

(4) Skilled operators.

(5) In progressive types of machines such as the Boltmaker, good first station extrusion is a prerequisite for proper heading and extrusion in the second station. First station extrusion today is practically exclusively on carbide extrusion dies which through their ideal wearing qualities resist the tendency to gall or pick up material from the bolt. If such galling happens to take place, the coating is scraped off the wire and galling naturally develops in the second station die. As a result of this condition high temperature stresses may cause heat checks and subsequent flaking of the nib and failure of the die.

(6) Good cut-off.

(7) Proper die proportions.

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THIS last factor of proper die proportions places undesirable limitations in some instances on carbide heading dies. The chief trouble is that of insufficient casing diameter. In the conversion from steel dies to carbide dies for a given machine a carbide die is naturally expected to fit the die holders that are bored out for steel dies. While the carbide nib used in heading dies is tough, it still is brittle and weak in tension. It is therefore necessary that it be kept in a state of compression at all times in order to prevent premature failure as a result of fatigue stresses. It is held in compression by the radial shrink pressure exerted by the casing. If the casing wall thickness is thin on account of limited casing diameter, the die is weak and susceptible to early failure. Correction of this difficulty through increasing the casing diameter and consequently re-boring the die block in the header is limited by the stroke of the cut-off knife or

the center to center distance between cut-off quill and the heading die.

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IN general this condition is characteristic of older machines, although we feel that in certain instances recent machines do not offer sufficient casing diameters for carbide heading dies. We feel that this factor should be given careful consideration in order to increase the operation efficiency of these headers through the use of carbide heading dies which should find adaptability for the large percentage of the products made in that machine. It is apparent that whenever the casing diameters are limited, sufficient casing wall thickness is obtainable only by reducing the diameter of the carbide nib.

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STANDARD nibs having a definite relationship of OD with regard to ID have been in use for quite a few years and we feel that any appreciable reduction in the nib diameter weakens the nib. This conception is based on the principle that the ability to absorb shock is a function of the volume which in turn is proportional to the diameter and length of the nib. Any radical reduction in the nib diameter to suit limited casing diameters has been found to give unsatisfactory performance. Wherever possible, therefore, it is desirable to increase the diameter of the hole in the die blocks to provide the maximum or desired casing diameter. Definite proportions between casing diameter and nib have been established as a criterion of good design.

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ANOTHER factor to observe is the avoidance of sharp corners in the shallow counter bores in the face of the die for forming the washer faces on finished bolts and aircraft bolts. These radii should be the maximum permissible for the product otherwise chipping and spalling inevitably develops, Fig. 3, as a result of the high stress-concentration resulting from sharp corners. For the same reason, the maximum permissible mouth radius must also be used. These radii are illustrated in Fig. 4.

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THE use of counter-bores for forming the head on the face of the carbide die is impractical for the reason that large flakes commonly break away from the face of the die in the early stages of production and render the die useless for further production, Fig. 5. This does not imply that carbide heading dies cannot be used for those operations where it is necessary to confine the headed metal. Generally the heading die can be held in a special sleeve which can be so designed to properly hold a replaceable hardened steel washer having the required cavity in front of the heading die. Where counter-bores are used primarily to limit the spread of the head metal and thereby reduce scrap losses in trimming, we feel that the extra production obtained from carbide heading dies without these counter-bores more than offsets the loss in scrap. It would be natural to believe that the extra strain would cause more rapid wear of the trimming dies, but peculiarly enough this condition has not been reported.

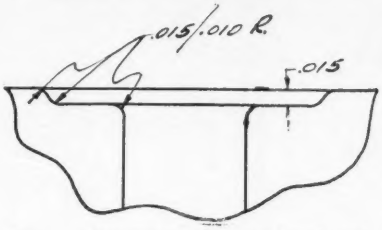

Fig. 4. Recommended radii for mouth and washer face. ✦ ✦ ✦

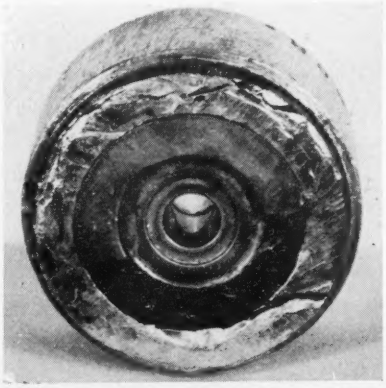

Fig. 5. ✦ ✦ ✦ ✦

THE use of carbide heading dies is most successful for those products having relatively thick heads. These products are hex-head screws, aircraft bolts, round head machine and wood screws, round head rivets, tinners rivets, and similar products. Apparently the reason for the ease of heading thick headed products is that the metal does not work-harden too much and provides a cushion for the heading blow. More difficult-to-head products are the thinner headed products such as clevis pins and bolts, and counter-sunk rivets and screws. Successful operation on countersinks and also round heads in a large measure depends on carefully setting up the heading punches so that at the expense of producing a small land on the OD of the head, the punch does not come close enough to the face of the nib in the die to impose a direct blow on the nib. Continuous operation under this condition nccessitates the use of well maintained headers.

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SINCE it is necessary to have sufficient casing wall thickness to provide the proper support for the carbide nib, it is apparent that deep set-screw flats are very undesirable. We have recently stressed this point and suggested to the users that the die be supplied without set-screw flats which would then be provided by the user who would simply locate the flat to suit the machine by setting the die in the die block and spotting the location at which the set screw bears, afer which the minimum depth set-screw flat could be ground to suit the machine in which the die is used. Whenever the die is to be used in any of several machines of the same type, the minimum set-screw flat would have to be determined in a similar manner to suit the slight variations in set-screw locations in the die blocks.

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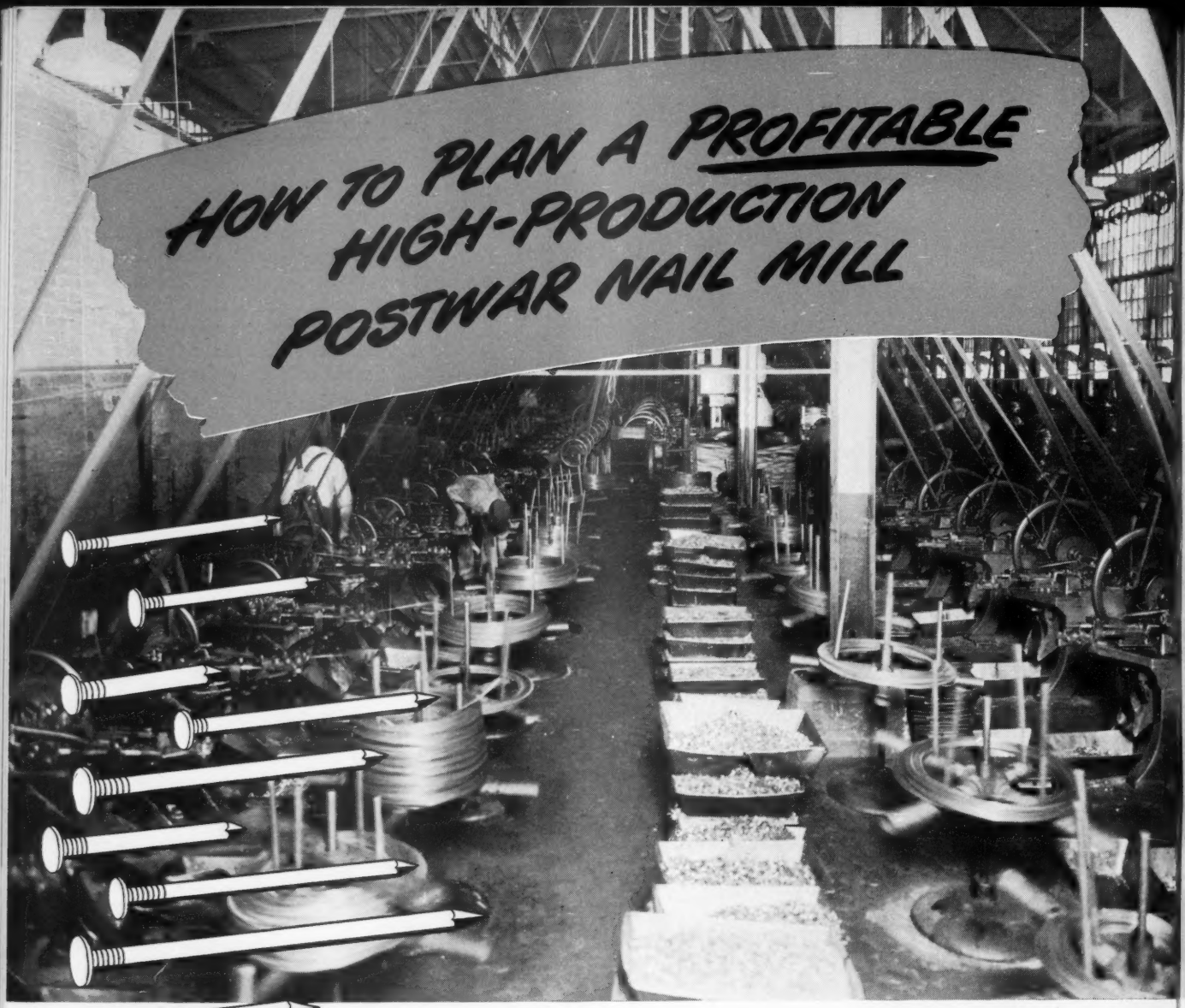
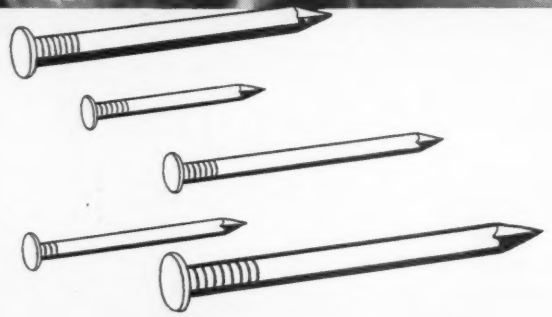
BEST results are obtained whenever the length of the carbide nib is greater than the length of the product as the product is then confined entirely within the nib, an ideal condition from a wear resistance standpoint. However, manufacturing difficulties and die cost limit the length of the nib and in order to provide re-

(Please turn to page 81)

HOW TO PLAN A PROFITABLE HIGH-PRODUCTION POSTWAR NAIL MILL





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WIRE ASSOCIATION PROCEEDINGS

Meeting, Monday, October 16, 1944 - 2:30 P. M.

Chairman of Meeting

E. W. Gundstrom,
Asst. Plant Manager,
Rome Cable Corporation,
Rome, N. Y.

OPENING ADDRESS	D. D. Buchanan	President of the Wire Association
LECTURE: "Safety in Wire Mills"	R. H. Ferguson, Manager of Safety,	Republic Steel Corporation, Cleveland, Ohio
LECTURE: "Handling Wire Mill Labor Problems"	John J. Sanderson, Asst. Supt. Wire Mills,	Keystone Steel & Wire Co., Peoria, Illinois

OPENING ADDRESS

The technical session of the Wartime Emergency Convention of The Wire Association convened at two-forty o'clock at the William Penn Hotel, Pittsburgh, Pennsylvania, Mr. D. D. Buchanan, President of the Association, presiding.

The President: Members and Visitors of our Association. We welcome you to the opening meeting, especially so as this meeting is the first, you might say, that our Association has not been connected with the A.S.M.

I want to thank you for bestowing on me the honor of electing me your President. I will endeavor to carry on and do what work should be done for the Association and the betterment of it. As the previous Presidents have set a high standard, I will endeavor to carry on that standard and try to exceed it.

Some of you may wonder why we have changed from Cleveland to Pittsburgh. That was of necessity, due to the hotel situation. As you all know, the A.S.M. has grown to such an extent that it has become unwieldly and the hotel situation in Cleveland was such that we could not be assured sufficient rooms.

Therefore the Directors and the Secretary felt the first thing we should think of was the membership and see that we were properly taken care of and that we conduct our business and hold our meetings in the proper manner.

It was decided to meet here in Pittsburgh. I think that our conditions here in Pittsburgh are far superior to anything that we could get in Cleveland under the present condition.

The program has been arranged for the Ferrous Division so that any who wish to go to Cleveland to see the exhibits, which I know some are interested in, will be able to do so Thursday and Friday. However, I should like to point out that on the Nonferrous program on Thursday there are some very interesting papers, and we have as a whole on the entire program papers which should be of interest to the entire industry, as The Wire Association is made up of men, who from our experience in past years, we know are vitally interested in the production of wire, also its installation. That particularly applies to the fine wire group.

Since our convention in Chicago last year, there have been regional meetings in Worcester, Pittsburgh, and on the Pacific Coast. I might say that the response and interest shown were very fine at the Pacific Coast meeting in Los Angeles, which was new. There were sixty present at that regional meeting.

I think the Program Committee deserves many thanks for the fine program they have worked out. That, of course, had to be contributed by members and there have been many hours of work spent, probably days, in working out the papers.

I think it is no more than right that the members should take advantage of the information that is being presented here in these papers so that they can become familiar with the details of the research work. I believe it would do all of us good to attend the meetings and get out of them what we can.

In the Nonferrous papers on Thursday, while it may be unrelated to steel, nevertheless there are many things in the nonferrous industry that we do in steel. After all, they draw the nonferrous metal and probably handle it in the same manner. There is no one who can pass up the opportunity to pick up some valuable information.

It was called to my attention yesterday that there has been quite a bit of development in plastic insulation which will affect products. That is particularly true in fine wire and insulated wire. The same method will be used not only in nonferrous but in the ferrous wire.

Of course, these conventions are held for the exchange of information and the good fellowship. The Wire Association, I am very happy to say, has more good fellowship than most. It is not too large and everybody knows everybody else, except that each year we find there are new faces.

I think all of the members who have been attending these conventions should make it their business to get acquainted with the new fellow. We have them every year and there are some here now. There are some men here whom I have never seen before, so let's get acquainted with them.

I wish to say that Signal Corps wire, according to the WPB, is still on the critical list. Regardless of what we hear about the war being near the end in certain sectors, it is not over, so every one of us must still keep our shoulder to the wheel and do a good job.

I am turning the meeting over now to Mr. Gundstrom, who is Chairman of the Program Committee. Thank you.

(Applause)

(Mr. E. W. Gundstrom assumed the Chair.)

LECTURE: "Safety in Wire Mills"	R. H. Ferguson, Manager of Safety,	Republic Steel Corporation, Cleveland, Ohio

The Chairman: The first subject for this afternoon's session is, "Safety in Wire Mills." I think that it's a subject in which we are all vitally interested. Allow me to introduce Mr. R. H. Ferguson, Manager of Safety, Republic Steel Corporation, Cleveland, Ohio.

Mr. R. H. Ferguson: Mr. Chairman, Mr. Buchanan, Members and Guests of the Association: It was with considerable temerity that I accepted this invitation to say a few words here this afternoon, because some of you will remember that several years ago in Cleveland I addressed the Association on quite a similar subject.

It is like the experience I had some years ago during the hot summer months out in the Dakotas. I made a rather hurried trip out there to make a safety talk for one of our good customers. I do not know why I was selected, but I was. It happened that particular time was one of those hot summer months and they had not had rain there for weeks and the crops were burning in the fields.

Nevertheless we had this meeting and I made the talk. When it was all over, one gentleman from the back of the room said, "That was a good talk, Mr. Ferguson, but I think thirty minutes of rain would have done us a hell of a lot more good." (Laughter)

I know the most we are going to get out of this subject today is going to be from a discussion standpoint which must come from you. I do not stand here posing as an expert, that I know all about this subject, not by any means. We have been worked on by experts and you cannot hurt my feelings in this business because I will learn a lot more out of it than you do and I will make that application in my business; but I am happy to be here because with the chaotic condition we are faced with in many of our industries today, the subject of industrial relations is pertinent to every one of us.

It is going to be, may I repeat myself, more pertinent in the days to come perhaps than it is now and number one among the industrial relations subjects is safety. You have heard a lot during the past years and you will hear a lot more about wages, hours, and working conditions. The thing we are going to talk about today generally is working conditions.

I took the liberty of developing this paper from a little bit different standpoint than you would be led to believe from the subject, but nevertheless I do want to approach it from the general angle and I do hope you will feel free to discuss it from this or any other angle, and do not be afraid to tear it apart.

(Mr. Ferguson presented his prepared paper, with the following interpolations:)

No. 1: Preceding the words, "During the same period, 1,850,000 employees," etc., Mr. Ferguson said:

Might I say right here that I developed this paper from this angle primarily because it is not the big company that employs thousands of people today that has failed to develop a safety program. It is the little organization of twenty-five or fifty or seventy-five people, and you would be surprised to know how many thousands of these companies there are where the word safety has never entered the front door.

No. 2: Preceding the words, "Laborer unloading bars into box car, bar weighing 148," etc., Mr. Ferguson said:

While we are talking about the handling of acid and pickling tubs and so on, I think it is advisable in our operations that men not eat in the neighborhood or in the same room where we are doing this kind of work. It is good to get them away from that particular thing because of possible contamination of food.

There was a situation in a Middle Western plant not so long ago where a man picked up a bottle by mistake which he thought was water and apparently contained acid. It resulted in a fatal accident. These things all turn on some of these points and while I have not discussed here in any particular detail the importance of occaptional disease as it affects industry today, yet I think in practically all the states in which you operate you do have in exstence today an occupational disease law and one which is going to have a lot more attention.

(Mr. Ferguson continued to read his paper to the end.) (Applause)

The Chairman: Very excellent paper. After each paper, the meeting is open for discussion or questions. Is there any question on this subject? I am sure Mr. Ferguson will be glad to answer any.

A Member: I would like to know what type of sling they use for handling cold drawn and centerless ground bars so you do not mar them with the chain.

Mr. Ferguson: We are using some braided slings and some slings wrapped with padding, sometimes fire hose.

The Member: We are using regular rubber canvas belts, the same as you use for drives and pieces of that kind. They have an eye in each end. Every once in a while we have a bundle slide out. There are two rings on the strap.

Mr. Ferguson: How many do you handle at a time?

The Member: We handle a ton at a time.

Mr. Ferguson: Let's ask somebody else what they are using on them.

A Member: We use a sort of a U-hook that will take a bar of steel and then drop from that a braid of rope, making a simultaneous slip of both ends of the material to be handled. We found it to be very efficient.

Mr. Ferguson: You know, Mr. Chairman, it might be a good idea if some of these suggestions which are practical things were to be reproduced in the publication, because those are practical, everyday operating and safety ideas that are exceedingly valuable. There are other ideas that I think some of these other gentlemen are using.

The Chairman: We will try to get them in the minutes and they will be printed. Are there any other questions?

If not, we will go to the next subject.

LECTURE: "Handling Wire Mill Labor Problems"

John J. Sanderson, Asst. Supt. Wire Mills,

Keystone Steel & Wire Co., Peoria, Illinois

(Mr. John J. Sanderson presented his prepared address.) (Applause)

The Chairman: That is a very interesting subject. Are there any questions?

A Member: What rate do you pay your men when transferred from one job to another? For example, the forty-six men transferred from the fence department?

Mr. Sanderson: It happens that these men in the fence shop were all on piecework and were given one week at an apprentice rate of 78 cents an hour. After a week's time, they then stepped into the rates within that department, which is an hourly rate plus the bonus.

A Member: Did you promise that when they started?

Mr. Sanderson: There was an agreement worked out between the management and the union at the rate which they were to be paid.

Mr. John A. Moritz (Keystone Steel and Wire Company, Peoria, Ill.): At the time these men were transferred from the fence department to the patent department, they were averaging around $1.40 an hour in the fence department. They went into the patent department for one week at 78 cnts an hour. After that week, they were given the regular patenting department setup, which was a guarantee of $1.15½ an hour plus an opportunity to make piecework. However, the work was rather strange to them and they did not average more than about three to five cents an hour for the first month or six weeks they were in there.

A Member: Was that made in a group bonus, all share and share alike?

Mr. Sanderson: No, each furnace has a setup of its own. They run for a calendar month. Each crew of so many men—and we consider a standard crew one with five men—has a required tonnage each day to get out. Say, the next day if they had four men, the tonnage would drop down. Then the next day they had six men, they would expect the tonnage to go up.

At the end of the calendar month, their expected tonnage as well as the actual tonnage is added and if they are over on their expected tonnage, the crew on that furnace would share.

Mr. Moritz: The reason that it is based on a month is because of the patenting unit where the speed is so very slow and you have from 32 up to 48 blocks on a unit. You cannot operate it on a 24-hour basis because one change in a round of wire would substantially increase the earnings in one 24-hour period and could by the same token ridiculously reduce the output in the next 24 hours. It might be that the same men might not be on the same furnace the succeeding 24-hour period, so you make it for a month average.

You could make it on a weekly basis, but it gives a more equitable distribution on a monthly basis, just that much more than it would on a weekly basis, and it would be out of the question on the 24-hour basis.

I might add another thing here for you gentlemen to think about. During the negotiating at Crawfordsville, Indiana, where they voted in the CIO two months ago—and we are now negotiating a contract but have not completed it yet and do not know how soon we will—it is significant to note that wherever a CIO goes in, they always present exactly the same contract. It is what they call a 22-point program.

I am just wondering why the wire mills all negotiate separately with an organization that presents a general picture straight across the board for everybody.

A Member: I would like to ask Mr. Sanderson what part the industrial relations department plays in the whole setup. Have they any authority or is it simply a mere adjunct of the superintendent's office?

Mr. Sanderson: Without stepping on anybody's feet, all those things are handled through the wire mill superintendent's office. In other words, we are the industrial relations department as well as directing the heads of the production in the mill, you might say.

A Member: I gathered that from your talk.

Mr. Sanderson: That is right, sir.

The Chairman: Any more questions? If not the meeting stands adjourned.

(The meeting adjourned at four o'clock.)

Session, Tuesday, October 17, 1944 - 9:30 A. M.

Chairman of Meeting

Julian L. Schueler,
General Superintendent,
Continental Steel Corp.,
Kokomo, Ind.

PAPER: "Cleaninghouse Practices"	F. P. Spruance, Vice-President,	American Chemical Paint Co., Ambler, Pa.
PAPER: "A Reappraisal of Electrogalvanizing"	Ernest H. Lyons, Jr., Chief Chemist,	The Meaker Co., Chicago, Ill.
PAPER: "Variable Speed Transmissions for the Control of Tensions and Velocities in Processing Wire and Cable"	J. H. Gepfert, Engineer,	Reeves Pulley Co., Columbus, Ind.
PAPER: "Cleaninghouse Practices"	F. P. Spruance, Vice-President,	American Chemical Paint Co., Ambler, Pa.

The meeting reconvened at nine-forty o'clock, Mr. Julian L. Schueler presiding.

The Chairman: We have three fine papers this morning and I hope there will be a good discussion on each of them. We are all interested in the three topics. They are vital to everybody who has anything to do with a wire mill.

The first paper this morning is one on cleaning-house practices by Mr. F. P. Spruance, Vice-President of the American Chemical Paint Company of Ambler, Pennsylvania.

(Mr. F. P. Spruance presented his prepared paper, marked No. 1.)

Mr. Spruance: I have tried to list these practices briefly. Pickling may be so old and well understood that there will not be any questions; but if there are, we will have some time to answer them. By the way, I would very much prefer having these questions answered from the floor. You men are living with pickling every day in the year. I know something about pickling from the outsider's viewpoint; so if we will dispose of the questions now, I think we can get more out of a discussion than were I to read the paper, which has been published in Wire and Wire Products. Thank you, very much. (Applause)

The Chairman: Gentlemen, the meeting is open for discussion. I hope that all of you have some questions you want to ask. Most of the value of these meetings comes from the questions that are asked and answered. You are only going to get out of this meeting what you put into it. You cannot get something from nothing.

Do not be afraid to talk because although your name will be taken so that you can edit your remarks later on after they are typed, your name will not appear in any of the publications. Your name will be shown as "a member."

A Member: How far would you go in controlling the temperature of your baths? How far would you go in keeping your temperature from going too high? Would you go to the extent of putting in refrigerating equipment?

Mr. Spruance: In answering these questions, please consider that although the question is directed to me, I would certainly appreciate any comments from the floor.

In answer to this question, the acid baths are usually used hot so that ordinarily it is not necessary to chill them. The sulphuric acid bath pickling is usually carried out at temperatures 140° Fahrenheit or higher, and the baths do not need chilling. They need heat, usually supplied by steam.

A Member: I wonder if anyone has had the experience that the copper-coating of wire with Cuprodine caused the dies to wear out quicker than if the wire is not copper coated. We copper coated patented stock followed by the usual baking, and we find that our dies wear out very much faster than they would have if we had used no coating whatever.

Mr. Spruance: That is a good question. Let me put the question the other way. Has anybody noticed that the dies last longer?

A Member: It might be that we are doing something wrong. It may be the way we bake the wire or it may be the lime is either too heavy or too light.

Mr. Spruance: Is there anyone here from the Page Steel and Wire Co.? Can you answer that question?

A Member: We do not use Cuprodine on rope wire. I think that Mr. Voigtlander puts the copper coating on his patented high carbon rods. We do not follow that practice. We use it more on the low carbon welding wire.

Mr. Voigtlander: We put it on high carbon.

A Member: We do not have that practice at all. I presume, offhand, that we would have decreased die life with copper coating on patented high carbon rods compared to just the regular lime coating.

Mr. Spruance: What lubricants are customarily used on the Cuprodine? Isn't that a factor as much as whether or not the Cuprodine is used?

A Member: We use the same lubricant on wire that is drawn copper coated. as on wire that is not copper coated. We use a tallow soap mixed with lime, and sometimes one of the various lime soaps, or one of the various lime soaps mixed with the tallow soap. That is our usual practice whether or not the wire is copper coated.

Mr. Spruance: Unfortunately I cannot give you any actual data on die life in the wire industry, although Cuprodine is being used very generally there. It is a matter of record in the steel cartridge case industry, on 1015 steel, that the die life was very greatly extended. That was true in all stages of the manufacture.

The cases, however, are annealed. They are relatively low carbon. They are not as high carbon as the rope wire which we are discussing at the moment, but there were actual records of very markedly increased die life.

A Member: We find that hooks are wearng away very fast, particularly at the acid level line. I can remember that years ago acid-resisting hooks were used anywhere from one to three years, but in the last two or three years these hooks have been giving away very fast.

In fact, they become pitted at the acid level line, the part immersed in the acid being in good shape. I have heard so many comments as to the cause of it I would like to have someone explain what is causing it, if they can.

Mr. Spruance: Personally, I do not know any reason why the hooks should corrode any more at the acid line now than at any other time unless there has been a change in the analysis.

A Member: It is generally conceded in acid-resisting material that at the line where the air and acid contacts the material, just at the top of the bath level you get considerably more corrosion than you do where the material is completely submerged in the solution or where it is outside of the solution.

A Member: Whether you are agitating by steam or some other means, you have not changed the process.

A Member: Yes, you have changed the process. If you agitate with steam or with air, there is your difference. The air agitation where it changes your pickling from a reducing to an oxidizing bath, makes a difference in the reaction on your acid-resisting material.

We have found that although it is tougher on acid-resisting material, the change of the bath from reducing to oxidizing does increase your pickling in such a way that if you handle your pickled material the way it should be handled and pull it from the bath when it is pickled, the volume of material which can be handled by any given hook will be the same.

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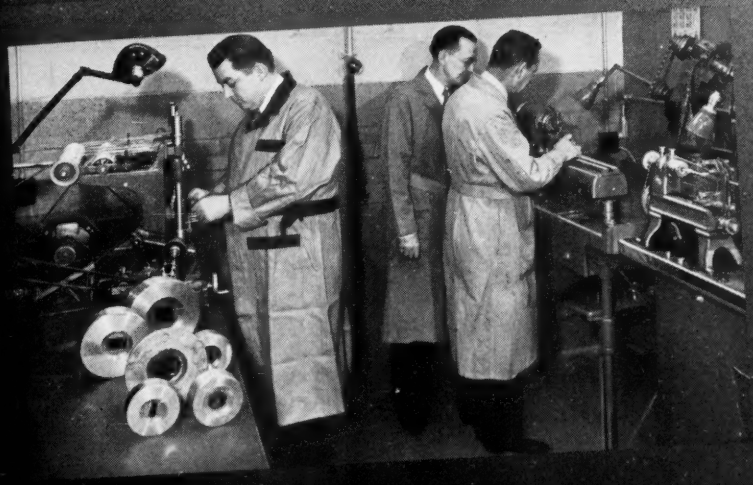

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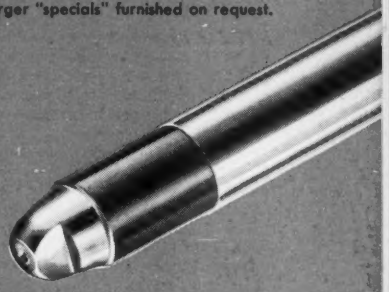

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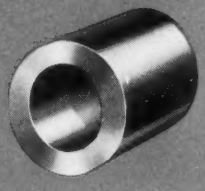

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A Member: I am talking about the same installation; no change has been made in the process. The same hooks have been used and all of a sudden in the last two or three years those hooks are going to pot.

A Member: That is something I could not answer. I was under the impression you were asking a question concerning the two different setups.

A Member: No, the setup is exactly the same. The only comment I have had so far is that some of the cleaninghouse operators say the reason is due to a change in the acid, or in the inhibitors, or things of that sort; but they do not seem to be able to find out exactly what the trouble is. The casting is the same. That is the strange part of it.

A Member: We have that trouble at our mill. We got the usual acid-resisting metal from a company which you probably all know and we have one hook which we had to discard in one year and two months. It had holes so badly eaten through it, at the acid line, that we were afraid to use it any more. You could stick lead pencils through the holes and the casting was very much thinner.

I put the matter up to a bronze manufacturer in our district and he said there are one of two things wrong: either the process of mixing is not correct or else the mixture itself is wrong. He said they used aluminum instead of lead, and this would make a mixture which would not last as long as the other hooks would last.

Consequently, we had him make a pattern and cast six hooks for us of a rather different design. We have not had them long enough yet to know how long they will last, but he gave me his formula and anybody who wants it may have it. He claimed that when he puts more lead in the alloy the metal will be softer and not quite so strong, but it will last longer.

The Chairman: Are there any other comments on that subject?

I think you will find that this action on bronze hooks in the sulphuric acid bath is not new. Most of the hooks are bronze. This type of corrosion has been known, to my knowledge, for many years. The design of the hook will help some; that is, if the hook is thickened slightly at the acid line, that is at the contact point along the top of the bath, it will last longer. Then, too, if you apply some acid-proofing compounds—such as some of the organic compounds that are available for that purpose—you can prolong the life of the hook.

There must be other questions. If not, I have one. At what point in iron-sulphate concentration is it advisable to stop pickling and change the bath?

Mr. Spruance: There is a variation in the optimum amount of iron sulphate in the pickling bath. It will, however, approximate half a pound to the gallon, roughly 6 per cent iron. After a bath has reached that concentration, the acid activity is slow and it does not pay to continue adding acid much beyond that point.

The usual practice is to heat the bath to increase the acid activity for reasons which I have previously mentioned and to run the acid down as low as it will go and then dump it. I have indicated in the printed paper a chart which, if kept, I think will improve the pickling house records. It will certainly give the supervisors an opportunity to see what is happening, and one of the important things is that it will enable them to know at what concentration the acid bath is discarded, because a great deal of acid can be wasted after the bath is dead.

The Chairman: I wonder if any of the members would care to give some of their cleaning house practices; that is, concentration of acid, both for low carbon and high carbon, temperatures of the pickling bath, and what means they have for controlling those conditions. Mr. Sanderson of Keystone, would you care to give your practice in that respect?

Mr. Sanderson: I think Mr. Kleffman, our cleaning department foreman, could probably give it better than I.

Mr. L. Kleffman (Keystone Steel and Wire Company, Peoria, Ill.): We usually run our baths down to about 15° Baume and dump it. On high carbon, we run the Baume reading to 10° and then dump the tubs. We carry the temperature about 140°F. and on fine wires about 125°F.

We use shakers on our acid baths to keep the wire moving around on the hooks. We have hooks used for holding rods in a sulfuric acid bath that I know we have had for ten years and we are still using them.

Mr. Spruance: May I just make one comment in connection with hooks and pickling and acid activity in general? It may be that the annealing of hooks will have an important influence on their life. For instance, I remember a good many years ago we had this experience in working with one of our materials.

We would bend a nail and put it in a breaker containing an acid solution with some phenolphthalein or other indicator, and where the nail was stretched or stressed on the convex side, you could find that that area was much more reactive than where the metal was compressed, so the stresses that are set up in any structure will increase the acid activity.

I think the practical application of that to the question you have raised is that perhaps due to defective annealing or not enough annealing, the hooks will wear out more rapidly than formerly.

A Member: One gentleman said he had hooks that lasted for ten years. We have them, too, but the ones made in 1942 are the ones that are wearing out fast.

On the other question as to how long could you use acid before discarding it, and at what iron content? Of course, you know we make high carbon steel wire, mostly rope wire, and it is very expensive and we concentrate on smaller sizes. We dump our tubs every day. The iron content does not go much over 2 per cent.

If we get too much iron in solution, we find the wire darkens and we have a lot more scrap. We do not care if we throw away a ton of acid. It may cost about $25 or $30 for a ton of acid and you can put $30 worth of scrap in a small wheelbarrow.

The Chairman: If there are no further questions, we will pass on to the next paper which is, "A Reappraisal of Electrogalvanizing," by Mr. Ernest H. Lyons, Jr.

PAPER: "A Reappraisal of Electrogalvanizing"

Ernest H. Lyons, Jr.,
Chief Chemist,
The Meaker Co.,
Chicago, Ill.

(Mr. Ernest H. Lyons, Jr. presented his prepared paper.) (Applause)

The Chairman: Gentlemen, you have heard an unusually frank paper. There certainly ought to be some questions you want to ask about it.

A Member: In hot galvanizing, if the lubricant is not properly removed from the wire, we usually have what we call a black condition. We recently had some electrogalvanized wire in the plant—if I remember correctly, it was 9-gauge—and what I wanted to ask Mr. Lyons was in comparing that to hot galvanizing, if the wire is not clean, do you get a black wire or do you get a poor bond on the wire?

Mr. Lyons: We have had both cases. If the wire is terribly dirty, no zinc deposit goes on the dirt at all and then it is obvious and the wire is rejected immediately. However, it is more common for the zinc to be deposited with a very poor bond which may come off on the reels if it is poor enough, or, more likely, it will be detected by the inspection department when they make the so-called button test or any of the other adhesion tests; but it is true that if the wire is not perfectly clean, the electrogalvanized coating will not stick well.

A Member: You mentioned that after having been shut down and the solution cooled off, you had trouble in starting again. What is the nature of the trouble you have? Is it in the appearance of the wire?

Mr. Lyons: Largely in the appearance, but to some extent if the solution is very cold, it is not able to carry the full current with the voltage that is available. Naturally the generators are made to run efficiently at the operating voltage and sometimes you just do not have enough voltage to force the full current through a cold solution. However, there are also differences in appearance.

A Member: Is the bad appearance a sort of white, powdery condition?

Mr. Lyons: Yes. It has a sort of dull, drab appearance and looks sort of frosty and dusty. As a matter of fact, some of our corrosion tests, and accelerated corrosion tests, on that wire seem to show it is about as good as the good-looking wire so far as resistance to corrosion is concerned, but we recognize that the customer does not like it on account of its appearance and, therefore, we do not accept that wire as good wire.

A Member: Could the process be speeded up if you had an extraneous form of heat applied to your plating solution? Sometimes you say it takes eight hours to start up. If you had, say, an immersion heater or something similar, would that help?

Mr. Lyons: Yes, that would certainly do it. We have discussed in various plants the putting of steam oils into the storage tanks so the solution could be heated before starting. Nobody has ever been interested enough to actually have that done, but we know from operation in our own shop that that is perfectly satisfactory. If the solution is heated, you can start right out just as if you had been running right along.

President Buchanan: I think these two papers this morning are very important. It goes back to one thing and that is the cleaning. You know, I think there is one thing that all steel producers have not given the attention to in the past years and that is cleaning house. That steel must

be cleaned; otherwise, when you process it, whether it is drawing or galvanizing or what have you, you are going to get a variation in your coating. You are going to have trouble with your dies.

I think if it was thoroughly cleaned and properly cleaned, you would get a uniform coating. Is that correct, Mr. Lyons?

Mr. Lyons: We get a uniform coatng usually anyway. The effect of cleaning is a poor bond. If the wire is not cleaned, the bond is poor.

President Buchanan: That is what I mean, the bond. I might say that we have started in some of our plants and we found by rehabilitating the pickling room that it really paid dividends on the product, because your pickler usually is in an old place, the building is usually just a hole. We do not keep it painted, we do not have good floors as a rule, so what incentive is there for the man to be proud of his product? I think we have to analyze it.

We put in a new plant, the Hamilton one, in Hartford, and that is one thing we paid particular attention to—the pickling room. Our products are heavier than most of yours, but the same thing could apply. This plant in Hamilton was finished December 30, 1942. It was painted in February, the pickling room, white with battleship gray border.

Gentlemen, you can see it yourselves today if you want to. It has never been panted since and the air in it, I think, is a little better than this room. We use an exhaust. We pull in air. The cleaninghouse men are proud of it. Around the tubs and the machinery, every few days they are coating it with acid resisting paint to keep it shining.

It has reflected on the product very definitely and I think housekeeping is going to save us a lot of troubles if we start back there. We did try out proper cleaning not in galvanizing but some coating. We were very careful with the bar to keep it clean. We did not have any dirt on that bar. Another bar we just handled the usual way. There was a difference of processing.

I think it all comes down to what you say, that we should do a good job of cleaning.

Mr. Lyons: I would like to second that very heartly. The better housekeeping and the better cleaning that is done, the easier it is for us when the wire comes to be electrogalvanized. You cannot run an electrogalvanizing machine without good housekeeping. The tank and all the equipment have to be kept reasonably clean. Otherwise you have dirt on the wire and as soon as there is dirt on the wire, your zinc does not come close enough to the steel to be bonded by the atomic bonds and, therefore, you have a poor bond and rejects, scrap, and all sorts of trouble.

I do not mean that you have to keep an electrogalvanizing plant as you would the clinic of a hospital, but just the same you must not have piles of dirt around. There must not be a lot of dirt coming down from the roof into the galvanizing tank or anything like that. Good housekeeping pays both in the plant and at home.

The Chairman: One of these gentlemen in referring to cleaning was talking about the importance of cleaning prior to drawing and there is nothing truer. If you want to cut down the die life in your wire mill, just send in rods that have not been cleaned properly. Cleaning is also important in the hot galvanizing process. You cannot hot galvanize a wire that is not clean.

Are there any other questions?

A Member: Do you have any trouble with flaking when drawing electrogalvanized wire?

Mr. Lyons: They had some trouble when they first started. After they had made the necessary adjustments—I was not told what they were—they draw it through and you can see a little zinc powder after a couple of hours drawing around the dies, but it does not amount to anything. You cannot see a flaw on the finished product. If you had so much zinc when you started, you still have that amount when you get through. Of course, the coating is thinner. It has been spread out over more surface, but it is exactly in proportion to the increase in surface.

A Member: I was thinking of this dull wire you were talking about that stood the erosion test all right but did not seem to have the gloss. I thought maybe that would flake.

Mr. Lyons: As far as I know, that particular wire has never been drawn because it looks bad and they think they will have trouble. We try not to make any more of that wire than we can help.

The Chairman: Are there any further questions that anybody wants to ask? If not, thank you, Mr. Lyons.

The next paper is, "Variable Speed Transmissions for the Control of Tensions and Velocities in Processing Wire and Cable," by Mr. J. H. Gepfert.

PAPER: "Variable Speed Transmissions for the Control of Tensions and Velocities in Processing Wire and Cable"

J. H. Gepfert, Engineer,

Reeves Pulley Co., Columbus, Ind.

The Chairman: Are there any questions you would like to ask Mr. Gepfert relative to this paper? I think it was rather thorough and explained about every type of problem that would arise relative to tension and speed control of wire.

A Member: May I ask the speaker, has the Reeves Company been working with any of the measuring people—particularly I am referring to applications of dials such as toolmakers would use, dial indication—so as to combine the measurement on the wire coming out of any process to bring that directly into your speed control? Or am I talking now of somebody's secret or proprietary article?

Mr. Gepfert: The answer to that question is rather simple for us in that the field of variable speed control is definitely not the field of so much cast iron or steel or parts. The only function of a mechanism such as the one we build is to provide production regulation and control.

Accepting that as a basic concept, if there is any process that can be regulated in relation to velocity or tension, then it can be applied to a mechanism such as ours because if, say, the force available in the process were low, we would require then only a torque amplifying means to adjust the speed of a variable speed mechanism. Suppose that the force were high, then we could operate directly. Suppose that the material were of a nature that we could not touch it, then we merely apply an electric or an electronic regulator to a photocell circuit to scan the material.

The answer to a problem like that is just as far as your basic concept will take you up to the point of control.

Again, in the early part of that paper, I said that you have three problems in a system. The first is that which you have and the second is that which you want. Our mechanism provides the changing element necessary to integrate. Actually, it is a continuous form of applying practical calculus to your production problems.

The most important part of a controller is this: that it is put into the system to control the variable. When a variable exists, it will move it back.

For a very specific answer, we build mechanisms operated by all of those units. We have hydraulically operated equipment, steam, air, electronic, bridge circuits—there is no end to the application.

We have, for example, in the textile field equipment that controls the processing rate of textile material in exact relationship to humidity and the moisture content of the material. That is operated from a series of electric and electronic regulators that would parallel the case you have.

So the answer is yes. So long as you can solve the three elements having to do with the control, we can do it automatically.

The Chairman: Are there any other questions?

Thank you, gentlemen. The meeting is adjourned. (Applause)

(The meeting adjourned at eleven-forty o'clock.)

THE ANNUAL CONVENTION OF THE

WIRE ASSOCIATION

will be held this year in Chicago at the LaSalle Hotel

October 15th - 19th, 1945

Members of the Wire Association are invited to submit papers for presentation at the technical sessions of the Convention. Please make your plans in this connection as soon as possible and advise us regarding them.

Meeting, Tuesday, October 17, 1944 - 2:00 P. M.

Chairman of Meeting

W. H. Crawford,
Resident Manager,

Reliance Spring Washer Div.,
Eaton Mfg. Co.,
Massillon, Ohio

PAPER: "Some Factors Influencing the Drawing of Fine Wires"	H. P. Edinga, Factory Manager,	Wire Division, North American Philips Co., Dobbs Ferry, N. Y.
PAPER: "The Physical Properties of High Carbon Steel Rope Wire As Affected By Variations in Patenting."	Howard J. Godfrey, Development Engineer	John A. Roebling's Sons Co., Trenton, New Jersey

The meeting reconvened at one-fifty o'clock, Mr. W. H. Crawford presiding.

The Chairman: I presume all of you who were here this morning heard the Chairman of the meeting state that a great deal of good—in fact, the most good—was obtained from these meetings through the question and answer period which follows the paper. I know the gentlemen today will be very glad to answer any and all questions put to them after they have concluded their paper.

I have the pleasure of introducing Mr. Edinga who has the first paper of the afternoon, "Some Factors Influencing the Drawing of Fine Wires." Mr. Edinga! (Applause)

(Mr. H. P. Edinga presented his prepared paper.) (Applause)

The Chairman: I think we all agree that your paper was most interesting and educational. No doubt there are other members here that do some fine wire drawing and we would be very glad to have any questions asked.

If there are no questions, we will proceed with the other paper. Thank you, very much, Mr. Edinga.

Our next speaker, gentlemen, is Mr. Godfrey of the John A. Roebling's Sons Company. His paper is entitled, "The Physical Properties of High Carbon Steel Rope Wire as Affected by Variations in Patenting." Mr. Godfrey!

(Mr. Howard J. Godfrey presented his prepared paper.) (Applause)

The Chairman: Some of you have questions you would like to ask, no doubt.

A Member: It would probably explain that the bend test and reduction in area are the highest at the lowest lead temperature because you have a better structure and not quite as much lamellar ferrite, which is an indication of much higher ductility. How could you explain the fact you had less torsion on a seemingly more ductile material?

Mr. Godfrey: I thought about that quite a good deal since getting this paper together and I have not been able to answer this question to my own satisfaction. One would think that ductility as measured by the bend test would also be reflected in the torsion test, but this is apparently not the case.

It may be that the torsions are affected by something else other than the structure of the grain. The 900° lead temperature gave the best bending properties and best reduction of area and this structure, having a higher tensile strength, may produce more temperature during the wire drawing process which in turn may have affected the torsional properties.

A Member: Mr. Speaker, I have a question with an answer. Do you know that torsion is as much a measure of the surface as well as of ductility, the kind of surface you have. The question is, in patenting with a lower lead temperature, do you affect the surface, slightly hardening the surface, more so than if you had a higher lead temperature and thus reduce the torsions on the wire which is patented at lower temperature? Have you ever taken any photomicrographs of the surfaces to show whether there are any differences?

Mr. Godfrey: The grain structure, you mean?

A Member: Yes.

Mr. Godfrey: No, we have not done that.

A Member: We have always thought the torsions not only measures the toughness but also the condition of the surface.

Mr. Godfrey: We have not actually tried to determine any change in structure over the cross section. I feel that in the wire of this dimension we should have obtained a fairly uniform structure.

A Member: I am trying to get at a reason for it and that is what I am suggesting it sounds to me right now.

A Member: At what speed did you draw the wire and did you water cool it?

Mr. Godfrey: The wire was drawn on single blocks with water-cooled dies at what may be called slow speeds, probably between 150 and 200 ft. a minute. Even at these slow speeds you might have a temperature effect which would show up in the torsional properties. That is the only explanation I have at present for obtaining lower torsions with the low lead temperature.

A Member: The fact that the lead quenched wire showed greater increase in tensile strength by drawing should be reflected in your torsions. In other words, the heat generated by cold drawing would be greater with the lower lead quenched temperatures.

Mr. Godfrey: That is probably right. It is not too consistent, though. The rate of cold working on the .75 carbon steel was 54 000 pounds per square inch for the 1100° and 60,000 pounds per square inch for the 900° lead quench, showing that the lower lead quench gave you a higher rate of work hardening which could be caused by the temperature of the wire.

A Member: If you had your choice of wire rope made either from wire produced to the figures of the highest peak—that is, the highest reduction of area and right-angle bends—or the wire rope made at the farther end of the curve where you had less reduction in area and less bends and slightly higher torsion, which would make the best rope as far as life, fatigue, and so on is concerned?

Mr. Godfrey: I wish I knew the answer to that one.

A Member: Would that be another question then that perhaps torsions is not the right type of a test to have on rope wire? I mean, if in order to get better torsions you have less ductility, I think perhaps some work ought to be done on that to determine whether you are getting a better rope or whether you would get a better rope at the highest ductility.

Mr. Godfrey: You are quite right on that, but my own personal opinion is that I would be willing to sacrifice a few torsions to increase the bending properties, provided that the torsions fractures were of the right type. In other words, if you obtained a good square break I would not care if the number of torsions was 35 or 38. I believe that as far as actual toughness is concerned, the reduction of area and the bending properties are better ones to use. For hot rolled structural steels the bend test has been definitely correlated to the so called "Necking Ductility Index".

The bend curves and the reduction of area curves do show a definite trend. We know that tempered wire itself without any wire drawing does not make a good rope wire and we know that when you draw wire to extreme, the wire will be brittle. There must be some point in between where we get the best material. The only curves that show a definite optimum point are the reduction of area and the bend curves.

THE 1945
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OCTOBER 15-19, 1945

There is one thing about that 900° lead quench which has not been discussed. The reduction of area curves did not follow along quite the same as for the higher lead temperatures. The bends started out high and gradually decreased with wire drawing, whereas with the higher lead temperatures the bends started out low and then reached a maximum. The structure obtained with the lowest lead temperature investigated here may have produced a structure which was somewhat different in character than was obtained with the higher lead temperatures.

What we really should do is to try and determine how the physical properties of the wire affect the service life of wire rope. That will probably be a long story. We do know however that the physical properties of the wire itself are affected considerably by the temperature of the lead bath.

The Chairman: Any further questions? If not, we will stand adjourned.

(Applause)

(The meeting adjourned at three-fifteen o'clock.)

During the presentation of the paper, figures were presented which supplemented the data on the rate of strain hardening as measured by wire drawing and by the tensile test. Figure A shows the curves obtained in the tension test on the tempered rod and Figure B indicates how the tensile strength of the rod was increased by wire drawing. The rates of strain hardening as measured by these two methods are in close agreement and indicate that the tensile test may be used for this purpose if the necessary corrections suggested by Bridgman are applied.

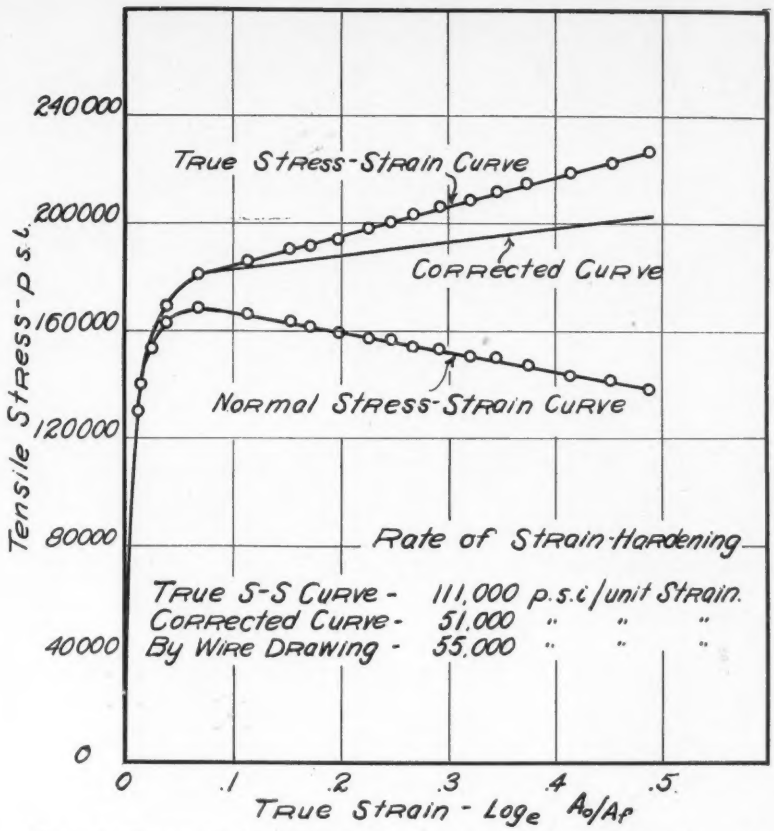

Fig. A. Tensile test on lead patented rod. .80 carbon steel. .348 in diameter.

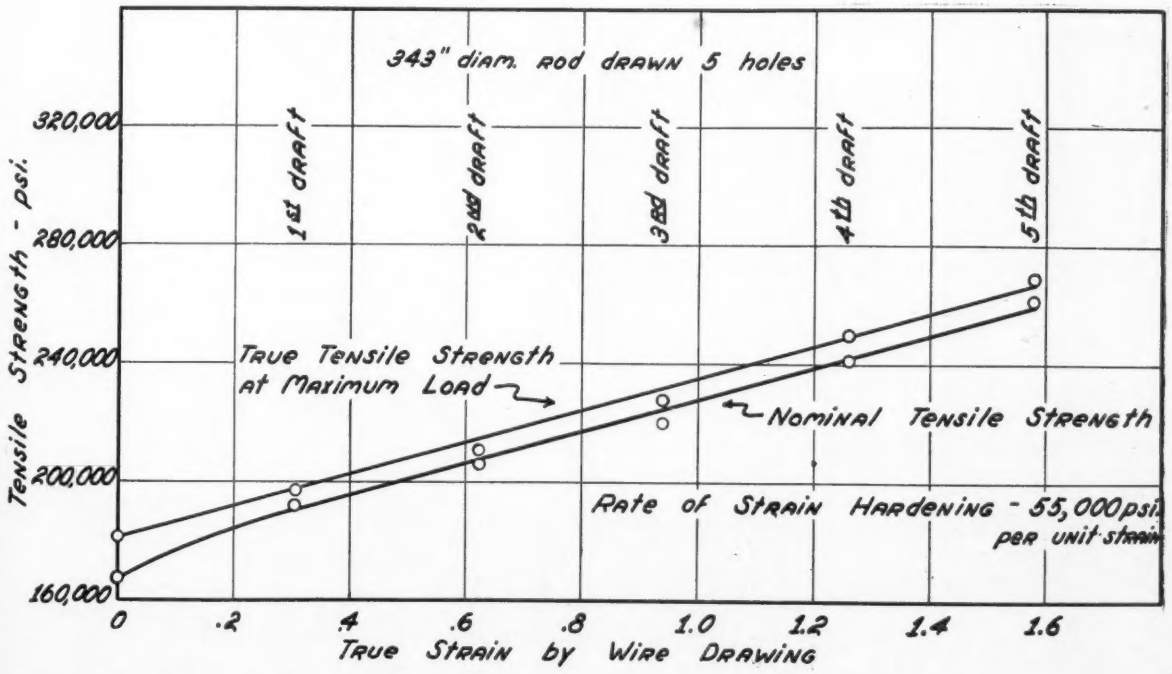

Fig. B. Effect of wire drawing on the tensile strength of .80c steel.

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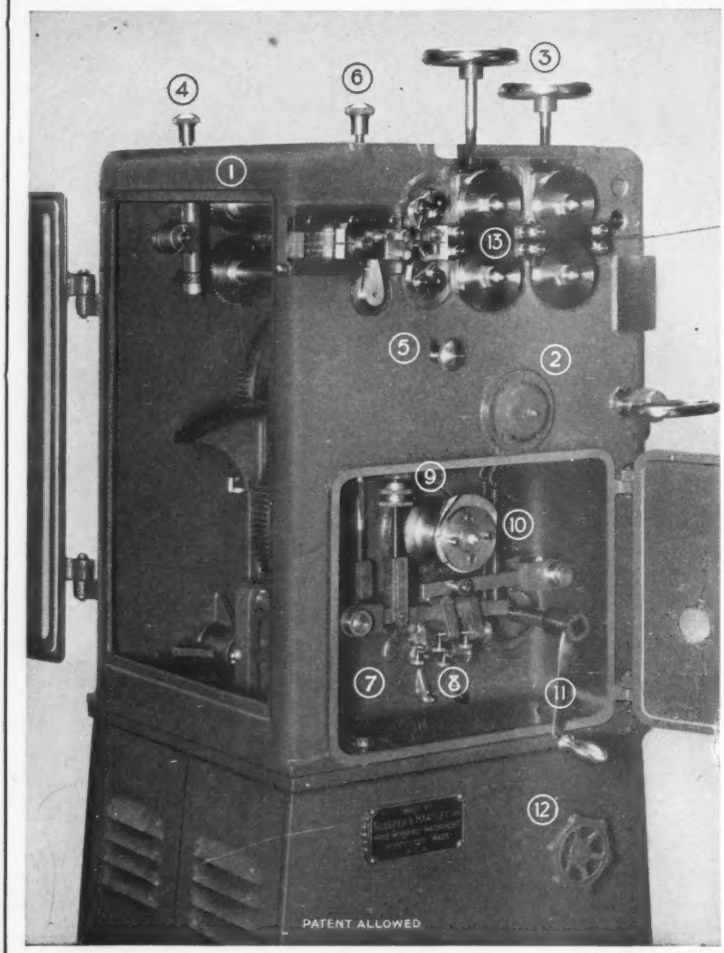

1- One piece cast iron housing for rigidity and perfect alignment.

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3- Individual pressure control for each pair feed rolls.

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6- Diameter control readily accessible.

7- Pitch and Diameter Cam control located in recess in front housing.

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DESIGNERS AND BUILDERS

Worcester, Massachusetts, U. S. A.

Session, Wednesday, October 18, 1944 - 9:45 A. M.

Chairman of Meeting

D. D. Buchanan,
President, The Wire Association

PAPER: "Dies" — A. R. Zapp, Manager, Firthaloy Div., Firth-Sterling Steel Company, McKeesport, Pa.

The meeting reconvened at ten-ten o'clock, Mr. D. D. Buchanan, President, presiding.

The President: Gentlemen, we have two very interesting subjects this morning. The first one is a paper on "Dies" by Mr. A. R. Zapp, Manager of Firthaloy Division. Everyone knows Gus Zapp, knows his weakness and knows his strength, but I think there is one thing that none of you know.

On Monday, we had a very interesting paper by Mr. Sanderson, Keystone Steel and Wire, on handling wire mill labor problems. We discovered last evening that Gus Zapp has become a very fine industrial relations man dealing with, you might say, near strikes. So if you have any labor troubles, get in touch with Gus and he will settle them some way.

We will proceed now with the program. Mr. A. R. Zapp, Manager, Firthaloy Division.

Mr. A. R. Zapp: Mr. Buchanan, Gentlemen: The only thing I am insulted about is that Bucky never asked me about my speed. The first thing he said was, "Is the show going on?" So I guess you better take me for the show rather than the paper.

In my paper, I have two articles, one on nail dies and the other on heading. I worked the two together because in their development they were so interrelated and came up togther at the same time that we could not separate one from the other. Several people wanted to hear the cold-heading part, so we reversed the topic and I am going to talk on the nail dies first.

(Mr. Zapp presented his prepared paper, starting with page 10 and continuing through page 14, following which he said:)

We spent about a year at this plant and at that time some of our common nail dies had run as high as 13,000 hours with not over one recut, and we have had dies on 20-penny machines about three years, 30,000 hours in the machines. You all know your average steel die. You change them once a shift and some of them oftener and at the very most, you get three to four days' run out of them.

We also at this plant started, as I said, work on our headers and our hammers and we have had very good success. However, the success in this plant was made on the machines where they drew the wire ahead of the nail machine. In other words, they had their own redrawn apparatus. They drew their own wire and in those cases, the machines never ran without any wire into them.

We have come to the conclusion that in order to make these really successful, it is going to mean continuous operation in a nail mill the same as you have in a wire mill. I feel the carbide is going to change the nail mill the same as it has the wire mill. In other words, we are going to come to it as we did in the wire mill.

The main cause for the nail mill at the present time is the labor. Most of this will be eliminated by welding ahead of the nail machines. Also instead of the small pans that are being used at the present time with the helpers pulling them out from behind, we will have large pans and some automatic system for removing them.

Therefore I think we will find that nail mills are going to go through the same evolution that the wire mills did, which brings me up to the cold heading because the two are absolutely interrelated and, as I said before, one worked over from the other or was an outcome of the other.

(Mr. Zapp then read his paper from page 1 through page 9.) (Applause)

The President: Gentlemen, you have heard the paper on dies, Tungsten carbide dies. I will throw the meeting open for discussion. I am sure Mr. Zapp will be glad to answer any questions.

A Member: I would like to ask Gus a question on his cold heading dies. I am not a cold heading man, as you all know, but we have always been taught that steel on steel unless separated with a lubricating film would tend to stick and cause galling. We have also been taught that dissimilar metals usually do not exhibit that tendency and I am very curious to know why a material like Tungsten carbide can be produced in most any hardness within reason, extreme high polish, very dense material, and should require a good lubricant on the wire for satisfactory use and good life of the die.

Mr. Zapp: The main thing that I can say is if the wire does not have a good coating, any slight imperfection on the wire itself shows up and sticks to the die and forms a gall or pickup, and that in turn increases the heat so that it fuses onto the carbide. Unless you take it out and clean it, it simply gets to be a buildup and you get enough heat to form checks in a carbide and from there on through, you are in trouble all the time.

There naturally is not a tendency to pick up on carbide as on steel because of the dissimilarity of the metal and the much higher polish you obtain, but we do run on some occasions into cases where with improperly coated wire we obtain pickups the same as you would if you were using a steel die. Does that answer what you wanted?

A Member: Not entirely.

The President: Your point was why doesn't the wire gall the Tungsten carbide, is that it?

A Member: That is correct. The point I am making is that the wire drawer has been told that he must produce a wire with a good uniform coating on it. Due to certain circumstances, he may get a condition where there are certain spots in the wire, let us say, of the cold wire, that are not covered 100 per cent.

When that wire is used in cold heading dies, I understand that those few little spots—they may only be an eighth of an inch long, but if you had three or four of those in a 300 or 400 pound coil of wire, would it be enough to cause a pickup and cause galling in the rest of the coil?

I am very curious to know why—you had 99.9 per cent of the coil coated—with that high polish, some physical phenomenon could not take place whereby that would carry through and the rest of the coil would go through all right. I am not speaking of attempting to draw wire, cold heading wire, that has no coating at all on it.

Mr. Zapp: I think in a good many cases if you have only a small amount of bare spots, it will carry through without galling; but when you figure the average life of a carbide die over possibly millions of pieces, I think your pickup does not come from a bundle, say, of 300 or 400 pounds where you have a few half-inch or inch spots not coated, because there will be enough in the choke of the die itself to carry it through.

I think your trouble comes when your wire is not perfect and you have a chance of having slight slivers or imperfect wire and it is not coated. I think the galling comes where the wire is not perfect and is not coated at the same time where you pick it up, because I have seen bundles after bundles that were not properly cleaned go through without any pickups.

Alan, you have done a lot of work on that; what do you find?

Mr. Alan Jackman (Firthaloy Division, Chicago): I have found that it is pretty hard to put your finger on just the reason for it. I think it is sort of a combination of two things probably that is the proper answer. We have experimented with coatings and we have experimented with heating the wire and we have done a lot of different things. One thing we have found is that it seems when you have a sharp radius, you have a tendency to get a pickup started. In other words, that will more or less scrape the wire and from then on you will get a drag through the die.

That is why Mr. Zapp suggested that the largest radius possible is the proper thing in the carbide cold heading dies.

One point that probably was not mentioned was that when you can have a cold heading die that will run several million pieces, your radius will practically remain the same. You will not be able to detect any change in radius.

On tool steel dies, you generally start with a sharp radius, so it gives you a little bit of wearing to get beyond your tolerances, and with carbide dies that is not necessary. You can almost start on your high limit and after tremendous production, you will still have the same tolerance.

Going back to this problem of galling, I think that you will find the same thing in wire drawing dies. You get some galling. When you once get started, you have to clean your dies out. There are certain irregularities that will take place that will

cause that, when you are scraping off the lubricant too much, or sharp corners, or variations in the material.

Mr. Zapp: I think we found that particularly so on aircraft, the difference on the radius, the difference between practically scalping it or else reduction of 8 to 9 million pieces.

The President: Any other questions? I have a question. Gus, what do you think the future is going to be in Tungsten carbide—do you think they will ever get to a point where tools will take more shock than they are today?

Mr. Zapp: Definitely.

The President: Do you think Tungsten carbide will get to the point where it will take the same shock as tool steel in the past?

Mr. Zapp: At the present time, carbide is taking shocks that we figured were impossible a few years ago. As far as shock goes, when you take your cutoff applications, particularly so on one type of nut machine which I will take as the worst application because you are cutting off a really short blank, in those cases both your knife or your cutter takes a shock and your quill takes a shock. A year and a half ago or two years ago it would have been absolutely an impracticability, so definitely we are getting them tougher and closing the gap between steel and carbide.

Mr. Jackman: May I make another suggestion? I have found that on shock resistance that carbide, if it is held under tension, will resist the fatigue limit so far beyond tool steel there is no comparison. Every time you hit on tool steel, it is more on the order of rubber. I mean, it will expand. In other words, we notice that when our blanks come out from carbide dies, the blank is merely a little larger, the amount of swell of the steel, whereas with tool steel dies your blank will come out .4 and .005 beyond; in other words, both the swell of the blank plus the opening of the tool steel due to the blow.

If you can prevent the carbide from moving, the fatigue limit is very high, far beyond the tool steel; but, of course, if the carbide is not supported, it will probably crack on the first few blows. Tool steel, however, is a constant fatigue just like soft annealed wire. You dent it enough times and it breaks, the same way with tool steel. It has a certain fatigue limit and will vary between maybe 25,000 to 50,000 breaks. There is a difference between the carbide and the tool steel in the fatigue properties.

A Member: Has anything been done on handling 75 carbon wire?

Mr. Zapp: Yes. We can head almost any carbon wire, but the production naturally will be a lot less than it would be on a milder steel. Your savings, though, would be relatively the same. I am talking on a die. I am not talking hammer.

A Member: No, just the die.

Mr. Zapp: We are doing quite a bit of work. We have punches and things working on equivalent of roller bearing wire, and we have also made quite a few balls, which is probably the hardest application you can get in ball bearing work. We have quite a few in successful operation in heading on making of the balls with all the ball bearing specification wires.

A Member: What is the condition of that wire? Is it in a spheroidized condition or full annealed condition?

Mr. Zapp: I had better call on a metallurgist. Do you know, Mr. Reeder?

Mr. Reeder: The high carbon wire is usually in a spheroidized condition.

A Member: I would like to say one thing and that is I do not believe, regardless of whether it is a carbide die or a common ordinary tool steel die, it is possible to use that die unless the coating is proper. You cannot go to work and head anything unless it has a coating because you cannot kick the piece out of the die again, so therefore would it be improper coating? At no time can you get any diameters out of anything unless it has been properly coated. That is on the solid die.

Mr. Zapp: That is correct.

The President: Any other questions? If not, I think something should be said about the Tungsten carbide. There are many fellows here who went through the last war. I think that Tungsten carbide did a fine service in this war. We all know during the depression we were able to reduce costs; but when you stop to think of the Tungsten carbide doing the job of turning guns, shells and what have you during this war — there has been some wonderful progress in the last ten or twelve years—I do not think we would have been able to produce the necessary armaments for the Army in the quantities we have had it not been for the Tungsten carbide development.

Thank you, Gus. (Applause)

(Announcements.)

The President: You know, each year an outstanding individual presents what we term the Mordica Memorial Lecture. This is a paper of high quality in the industry and a specified time is set for this lecture. The majority of the members are familiar with the importance of this paper, of what it stands for. However, there are a number of new members who no doubt have heard of John Mordica, but they never had an opportunity to meet him.

This paper is presented in honor of John Mordica. Mr. Mordica was one of the five founders and the first president of The Wire Association. He was an outstanding wire producer in his development of wire and it is still being carried on.

He was known as the Dean of the Wire Industry and Superintendent of the Bethlehem Sparrows Point plant when he passed away in 1937. He was also an individual that the wire industry could counsel with and was also aggressive at all times. I think that he would be very proud of the wire industry and the job that you have done during this war.

The Mordica Memorial Lecture was established in 1938 and, as stated before, we always have an important paper by an outstanding individual in the wire industry to deliver it, so it gives me great pleasure at this time to introduce Mr. A. M. Reeder, Metallurgical Engineer of Jones and Laughlin Steel Corporation. The topic is, "Carbon Steels for the Wire Industry." Mr. Reeder! (Applause)

(Mr. A. M. Reeder presented his prepared address.) (Applause)

The President: Thank you, Mr. Reeder. I think that was a very fine paper in honor of John Mordica.

Gentlemen, we do not discuss this paper. There is one thing I would like to say about it and that is, the research that has been going on in the steel industry has benefited all wire producers. Mr. Reeder pointed out still more research to be done. It is what we had some discussion on yesterday, going back to the beginning to solve some of our problems.

The meeting is adjourned.

(The meeting adjourned at twelve-ten o'clock.)

Session, Thursday, October 19, 1944 - 9:45 A. M.

Chairman of Meeting

C. A. Litzler, Chief Engineer,
The Industrial Oven Engineering Co.,
Cleveland, Ohio

PAPER: "Synthetic Insulation and Jackets for Wire and Cable"	G. A. Rolston, Chief Engineer,	Rome Cable Corp., Rome, N. Y.
PAPER: "Discussion on the New Plastic — Polythene and Its Adaptation for Insulation of Electric Wire and Cable, together with a Discussion of Plastic Used with Nylon in a New Switchette"	Dr. J. W. Shackleton, Plastics Div.,	E. I. DuPont de Nemours Co., Wilmington, Delaware

PAPER: "Synthetic Insulation and Jackets for Wire and Cable"	G. A. Rolston, Chief Engineer,	Rome Cable Corp., Rome, N. Y.

The meeting reconvened at ten-fifteen o'clock, Mr. C. A. Litzler presiding.

The Chairman: I believe that most members who are here know the person who is going to give this first talk this morning, Mr. Glen Rolston of Rome Cable.

Mr. Rolston has prepared quite a paper. In addition to that, he has brought along a number of samples. After the morning session, we certainly would like to have everyone come up and check into it and look at these samples. Mr. Rolston! (Applause)

Mr. G. A. Rolston: Mr. Chairman, I think it is somewhat of an imposition to get you fellows out so early in the morning to listen to what is not really a paper but what started out to be an informal discussion on synthetic insulation and jacket compounds.

A year ago at the meeting in Chicago I had the temerity to suggest that possibly it would be a good plan to include on your programs at least some discussions on insulation inasmuch as the first trial of that type of paper was made last year. I never thought at the time that I would be induced into trying to present such a discussion as the subject of synthetic insulation and jackets because they change so rapidly that I know anything I wrote in July certainly was going to be wrong in August and when September came along, it was even further wrong and as of today, I do not really know what the answer is because each day brings out some new situation on insulations and jackets.

But in view of the fact that the program committee said they would like to have a paper and that they wanted this paper printed prior to the meeting, I have written such a paper; but I hope that you will consider it as an informal discussion and that we can have a good knockdown, drag-out argument about synthetic insulation and jackets, not that I will answer the questions because I will merely tell you what I think about them. There are a good many wire men here that are far more able than I am to cover this subject.

(Mr. Rolston presented his prepared paper with the following interpolation:)

Preceding the words, "The processing of Buna-S has brought many problems," etc., Mr. Rolston said:

Here is one case where the situation has changed somewhat in that because of shortages of supply, a considerable quantity of the Buna-S from the Lake Charles plant is now being consumed in insulating compounds. The individual manufacturers can answer for themselves as to the degree of success and can make their own claims as to its performance characteristics. I still prefer to stick by the original statement that was prepared in July.

(Mr. Rolston continued to read his paper to the end.) (Applause)

The Chairman: It certainly seems as though Mr. Rolston has done an excellent job of covering a field that has a lot of ramifications. The thought has occurred to us—and I imagine that it will be borne out—that there is a possibility of many questions and further discussion on the subject. Does anybody here have any specific question?

Maybe Mr. Rolston could still further stick his neck out to give us some idea of what may be expected in the future on some of these developments that are now going on. Have you any views on that particular line?

Mr. Rolston: I have views, but I do not know how good they are.

The Chairman: I think maybe it would be interesting to find out.

Mr. Rolston: The thing I think both the consumer and the manufacturer are going to have to look forward to in this postwar period is probably considerable chaos from a standpoint of these wire products that are made with these various synthetic materials. It is quite obvious that you cannot prepare standards that are representative of the product that you will make until you have actually produced the product and had some laboratory and field testing.

Just as a sidelight for those of you who are not, you might say, in the insulated wire business, I would like to tell you how the specifications for Buna insulation and jacket were prepared and I think you will understand what I mean.

In the last week of June, 1943, the War Production Board advised the Technical Advisory Committee on Wire and Cable that they would have to have a specification for Buna insulating and jacket compounds within about ten days, so a telegram was sent out to representatives of a considerable number of wire manufacturers of insulated wire and we were all asked to appear in New York to collaborate in the preparation of these war emergency specifications.

When we got there, the story went something like this: Manufacturer A had had about 200 pounds of GR-S to experiment with and he had mixed up a coat compound and a performance compound. He had pieces of wire that were long enough to make an electrical test and he probably made a few aging tests.

Manufacturer B had requested 200 pounds, but he had not received his yet. Manufacturer C had had the proverbial 200 pounds, but he had made a little different compound and some other tests.

After we sat around and talked to each other, we decided that it was going to be a pretty difficult task to write a set of specifications which, incidentally, were going to be submitted to A.S.T.M. for emergency standards and then quickly submitted to the Office of the Rubber Director for the specifications that would appear under Rubber Order R-1.

But, as the story goes, the war was on and you had to write some specifications and, brother, we wrote them. They sat down and wrote the tensile strengths and elongation and aging and modulus and all the other things that go along with it, and those are the specifications that are still in effect today.

They were issued as the emergency specifications under the A.S.T.M. procedure and later, because there still was not enough information available, they were issued with regular D numbers, specifications of A.S.T.M., and they are the only reference specification that you have except those governmental agencies that have special testing performance requirements.

Let's visualize what is going to happen in possibly the next two years. Someone is going to take and mix a little of this and a little of that and they are going to have a compound. Another fellow is going to mix one of this and two of that and he is going to have a compound and in order toget some performance on it, he is going to send some good high pressure salesman out to call on the trade. They are going to tell him what they believe this material will do as judged by accelerated tests in the laboratory.

The result is that the fellow sitting on the purchasing side of the desk instead of being able to talk about what he has in the past—maybe coated compound or performance grade or heat resistance or heavy duty jackets—is going to hear about a hundred and one different things and some of them are going to have a great deal of merit.

Furthermore, we have already been told —in fact, the compounds are made—they are going to mix the thermo-plastic and

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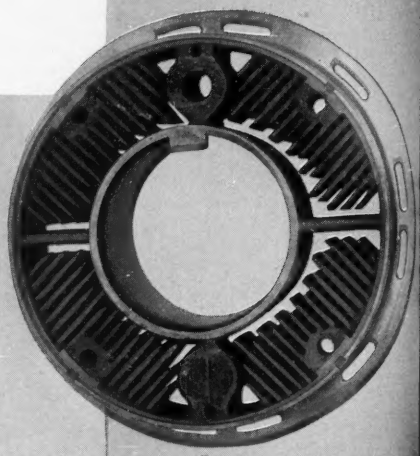

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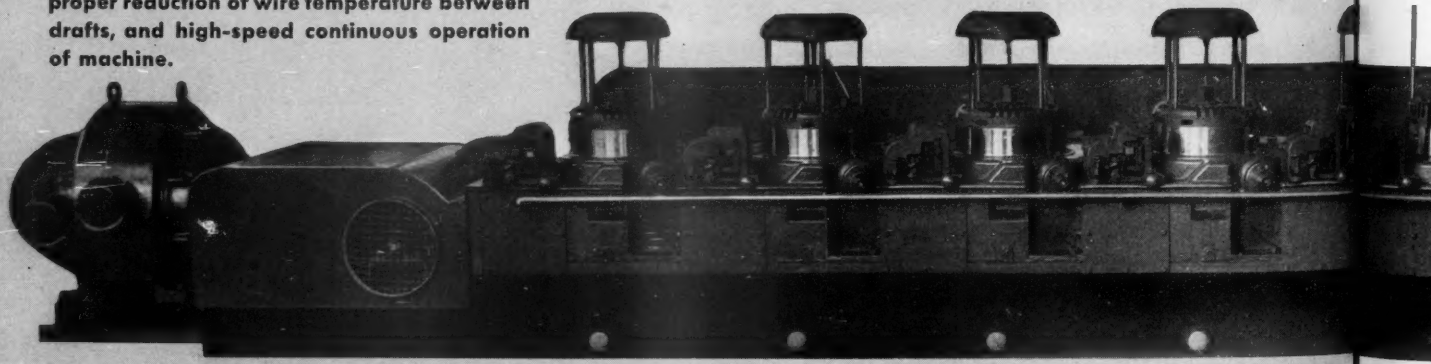

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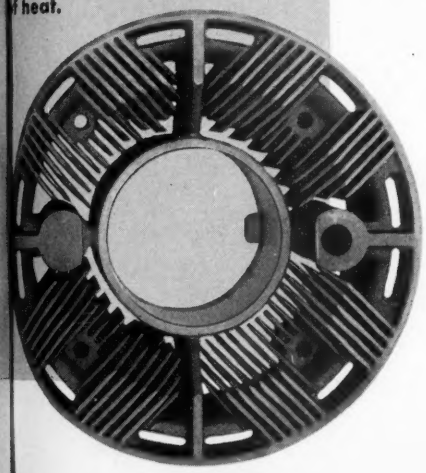

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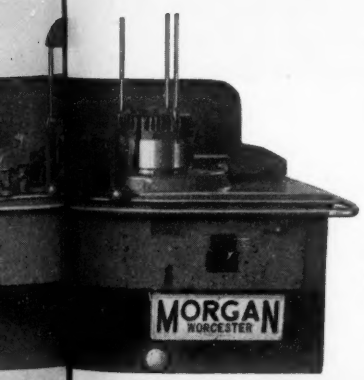

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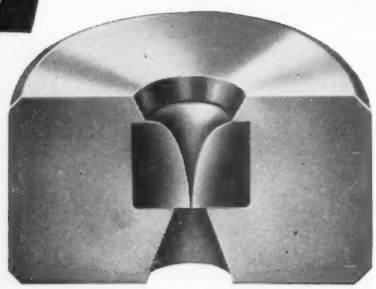

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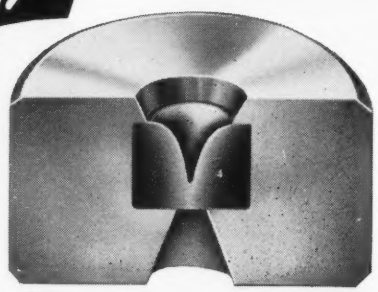
OLD WAY



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the thermosetting materials together and they are going to mix them together in an infinite number of combinations. That mixture is going to result in certain types of performance and I visualize that some day you are going to be able to have what you might call a custom-built wire.

If you have a special problem in which you have a condition to be met, we are certainly going to be in a better position to give you something for that service, assuming you do not want 500 feet of it, than we were in the past, because heretofore we had crude rubber and all the chemist could do was select certain compounding materials to improve its performance. But here you are going to have 101 or maybe 1001 synthetic materials slightly different i nmixture and then you are going to pour them all together in a pot and come out with certain specified performance characteristics.

I visualize a period, as soon as the war is over and these materials are available in quantity, of custom-built insulations and jackets for the wire trade.

The Chairman: It looks as though the wire manufacturers are going to have difficulty keeping track of so many different specifications and it looks as though the clerical setup will be worse than OPA. We have talked to several other people in the wire industry and they have all mentioned exactly what Mr. Rolston has mentioned: The fact that the day of specification wire is definitely here and that condition is going to continue.

Does anyone else have any further comments?

A Member: I have more or less an academic question here that I have been wondering about and maybe others have. Suppose crude rubber became readily available next week—maybe you cannot answer this question—how much of the synthetic rubber would go out the windov and you would hop right back on crude rubber next week?

I can anticipate part of your answer—you are not going to quit looking into these things you just spoke about — but I just wondered percentagewise what your own personal opinion would be.

Mr. Rolston: I have sat in so many of these meetings with other wire manufacturers, my competitors, that I do not mind telling you that from a straight production angle we would go back to crude rubber on insulations at least the minute we got some in the plant because we still have trouble with the variability of Buna-S or GR-S. I am not referring to the thermoplastic materials because they have a definite field; but in the question of the use of crude rubber against Buna-S as an insulation, we would change back on a production basis right away and, as you suggest, continue development work and study of the material, trying to learn how to process it more satisfactorily than we are at present.

From a manpower situation and difference in production speeds, higher scrap loss, and things of that type that we get with GR-S, we would welcome back at the present time the use of crude rubber as an insulation.

The Chairman: I think that same general problem is bothering the rubber industry. We have something to do with tire plants and naturally everybody wonders what is going to happen to the millions and millions of dollars' worth of synthetic tire fabric processing.

I have asked the same question to many tire people and they come back with somewhat the same remarks as Mr. Rolston has made, but what the final outcome will be no one seems to know. I think the problems are tied up pretty much with the same answer.

I see a tire man sitting back there. Maybe he has some viewpoint on rubber and insulation and the general question that is being discussed. Mr. Hawthorne, do you have any views on the subject?

Mr. Hawthorne: I am associated with it. The comments I get from Passaic are very much what Mr. Rolston said, especially they contemplate much lower cost on the material, too. That would be another cause for going back to the crude, and I do not think much could be added from our point of view.

The recent paper that was given by Mr. F. B. Davis, Chairman of the Board of the United States Rubber Company, covered the subject about as beautifully as anybody has so far, in talking of contemplating the cost of around 30 cents for the Buna or GR-S, something that cannot compete with what we could contemplate on natural or crude rubber.

The Chairman: I think there was an article in Rubber Age, an editorial by Mr. Collier, and he again brought out the same thing that it would be foolish to scrap all these synthetic plants because there are so many advantages inherent in the synthetic materials that maybe this idea of going back to natural rubber might not seem the thing to do.

A Member: I have a question which I hope is of general interest to the group relative to an apparent trend in the industry to produce wire on the order of instrument wiring, radio hookup wire, aircraft wire of a general nature which has only an extruded installation.

We supply an inorganic fibrous covering for wire applications and so that is of vital interest to us, and I would like to ask Mr. Rolston if he can tell us to what extent this trend in that direction can go with the products we know today? I am speaking in particular of vinylite and koroseal and that type of extrusion.

It is certainly very evident that that is the simplest type of wire construction that you could have and probably the cheapest as far as construction is concerned, but I am wondering if it will stand up under various usages that I have mentioned.

Mr. Rolston: Do I understand you wanted to ask my opinion on the extruded covering compared to a taped covering?

A Member: No, not necessarily a taped covering, but whether or not an extruded covering can be the whole answer without the protective fibrous covering for a number of these small wires in products as we know them today.

Mr. Rolston: That is an answer that can only come from the set manufacturers, and I will tell you what I have learned most recently. As you probably know, the reason for asking us to eliminate the fibrous coverings on wire used in radio, radar, and other sets, was the question of fungus resistance.

At first there was so little known about the type of material that could be placed in the coverings to resist fungus that it seemed desirable to get the fibrous coverings off and try to use an insulation that in itself was fungus resistant and avoid the whole subject of coverings. You will probably hear more from Mr. Jordan this afternoon about lacquer treatments on fungus that I will ever know, so I will not go into the merits of the case but just as we see it.

Consequently, certain branches of the armed service have issued instructions that equipment coming under their cognizance shall be made without a fibrous covering. The result is that on certain types of sets the wire manufacturer is furnishing an extruded thermoplastic resin compound without further covering.

The minute that ruling came out the set manufacturers were very much up in arms because one of the principal problems in connection with using thermoplastic insulated wires without fibrous coverings is the problem of soldering the connections. When these people were first told they had to do that, they threw up their hands in holy horror and some of them went so far as to say they would not do it.

The last information I have from three large companies making this type of equipment is that they did just what we did on all other war problems. They developed soldering methods for wire without a fibrous covering that are giving them results that are satisfactory to a degree. In fact, one of the three who also was the most vehement in the statement that it could not be done has recently decided to change over to such a type of wire.

I do not believe, however, that a wire without a fibrous covering will be generally used, at least on the types of sets that we are making now. Of course, what we are all concerned about is the postwar period and the guess as to what type of radio hookup and instrument wire will be used in the United States is—if I could guess it correctly, I would know what to do.

Right now we are very much confused on the subject. I do not have the least idea whether they are going back to pushback wires or thermoplastic insulated or they may use the taped constructions which we heard about at last year's meeting. I think all of us who make these wires are scrambling around trying to find out what they are going to do, but that is the best information I can give you at the present time.

The Chairman: Does anyone else have any questions or comments?

Then I think we'd better give Mr. Rolston the line of applause for, I think, a very interesting paper. When you do receive the printed copies of this paper—I do not mean to set myself up as being well read, but we do try to keep up with published information in these fields and I do not think I have seen anything more complete or a compilation that sets things down as accurately as this compilation that Mr. Rolston has and that accompanies his article. I think you should all make an effort to get a copy and retain it. Thank you, very much, Mr. Rolston. (Applause)

Gentlemen, this is Dr. Shackleton of E. I. DuPont. Dr. Shackleton's paper is on polythene, sometimes known as polyethylene, and he is going to try to give a complete background of the material. Dr. Schackleton! (Applause)

The Annual Convention of the
WIRE ASSOCIATION will be held this year at the LaSalle Hotel
October 15th - 19th, 1945

PAPER: "Discussion on the New Plastic — Polythene and Its Adaptation for Insulation of Electric Wire and Cable, together with a Discussion of Plastic Used with Nylon in a New Switchette"

Dr. J. W. Shackleton,
Plastics Div.,
E. I. DuPont de Nemours Co.,
Wilmington, Delaware

(Dr. J. W. Shackleton presented his prepared paper, paper marked No. 3, with the following interpolations:)

No. 1, p. 2: I have some slides I think might be of interest. I am going to try to cover things that will be of interest to the group. I may deviate from wire coating a little bit every now and then, but I hope to give you something that will be in your line.

(Slide) It is noted from the first slide that polythene is a very, very simple compound. It is a hydrocarbon chain consisting of hydrogen and carbon. It has excellent electrical properties. When you introduce other atoms such as chlorine in place of the hydrogen, you introduce polarity and, therefore, you increase your power factor.

Polythene is applied to wire with standard equipment and is recognized by commercial extruders as being a very easily handled compound. Some of you who may have handled it may disagree there, but all in all it does extrude nicely.

Wire coaters are rapidly learning to use this new material for the most part. One thing that is particularly important in producing polythene cables for thick walls is special cooling. That is, you run the coated wire into hot water and then cold water and because of the exact expansion of polythene and the chilling of an outside shell in the air and cold water which leaves the inside hot, you have voids, so if you run it in the hot water you do get a cooling that is efficient.

I will go right into the electrical properties of polythene. (Slide) You will notice that the dielectric strength is given as a short time. On a one-eighth inch sample, the test method according to A.S.T.M. standard methods is given in the far column. The one-eighth inch sample has a dielectric strength short time of 475 volts per mil. I will show you a curve on that in just a minute which will give you an indication of how that runs on other thicknesses.

Volume resistivity is high. The dielectric constant, you will notice, over a range of up to 108 cycles is constant, and the power factor is also constant.

(Slide) This simply gives the constancy of the dielectric constant with frequency and cycles per second and the constancy of the power factor—a very slight rise, as would be expected.

(Slide) This is the change of dielectric constant and power factor, with temperature, at three megacycles. That is a curve that has been requested by a number of manufacturers and it is a very recent curve which we obtained. On the power factor, I think electrical people will note, the curves are both very characteristic, as you would expect.

(Slide) This is the dielectric strength of polythene, compression-molded samples. We have done very little testing on wire. We are plastic people primarily. Our experience for the most part has been on the materials themselves and so this sample was a compression-molded sample.

You will notice in thin tapes the dielectric strength in volts per mg. is around 2000. We have extended that, but we only have data on one sample. That was a third of a mg. which ran 'way up around 3500 volts per mg., so it is a very interesting material for that reason. Generally speaking, it is about like styrene, I would say.

(Slide) This is interesting and indicates why an antioxidant has to be added to polythene. Polythene, if milled on a hot roll for a time, the power factor rises and it rises rather seriously. That is probably due to oxidation, as you would imagine, because when you add an antioxidant, this curve shows that over long heating milling conditions, you do not have any change in the power factor, so the brown color that you will notice in samples of polythene is due to the antioxidant.

(Slide) I will glance quickly over these other properties. Notice the water absorption is practically nil, about that of styrene which has always ben known as a very low water absorber. Flammability is probably the most serious drawback to polythene. We classify it among the plastics as a slow-burning material, but it will burn and will support combustion. We are very actively engaged in a program of reducing that flammability with a sacrifice of as little of the electrical properties and other properties as possible.

You will note the outdoor exposure shows no change if the material has antioxidant. Ultraviolet light tends to discolor the material if the antioxidant is not present.

(Slide) These are the mechanical properties which I will let you glance over for just a moment. Tensile is around 1900 psi. Elongation is high. Notice there are differences in elongation whether the sample is compression molded or a sample cut from a sheet. Modulus is 14,000, flexural strength, and so on.

(Slide) This is simply a slide giving the stiffness of polythene. We have said sevral times that polythene lies somewhere between the rigid and nonrigid plastics. Up above (indicating) you have methyl methacrylate or lucite and polystrene, which are very brittle, vinyl chloride acetate which is a rigid form. Down here (indicating) you have GR-S and vinyl chloride nonrigid, and right between them polythene.

(Slide) These are the thermal characteristics of polythene. The flow temperature—that is by the method of extruding through an 8-inch orifice under pressure of 1500 psi, I believe. Deformation under load is a method which we there proposed to the A.S.T.M. I do not know as these mean a great deal to you unless you have had some experience with these A.S.T.M. tests: but all in all as far as hte thermal characteristics of polythene are concerned, the heat resistance is a good deal higher than the vinyls, yet there is something to be desired on the deformation at high temperatures and we hope to be able to offer a polythene composition which will have a high service temperature.

You will notice the brittleness temperature at lower than minus 50. Actually we have never broken a sample at minus 70 in an impact tester and actually I think it would run down to minus 80 or 90. It contains no plasticides and that in itself is very interesting.

No. 2, p. 4: This is our own slide and this is our own information, but they did something similar to this in selecting twenty-three properties. We have only taken a few across the top. We have covered both jacketing materials and the insulation materials in our comparison. You will notice here butyl rubber, polythene, some of the vinyls, plasticized vinyl, acetate, and Buna-S.

We have compared some of the electrical properties. One means it is excellent; two, not so good; three, still worse; four, poor. We compared also the flammability, cold resistance, stress strain properties, oil resistance and resistance to ozone and sunlight. We have rated polythene excellent in these five cases (indicating). Flammability is poor. The stress strain properties we say are good. Slade and Crafton seemed to think they were excellent—just a difference in opinion. We like them to say it is excellent, however. Oil resistance we say is fair and they classed it as good.

Down here are some of the jacketing materials which I will mention in passing because in here is nylon which I want to discuss momentarily as a jacketing material. The flame resistance of nylon is excellent. Its stress strain properties are excellent; the oil resistance, excellent. It rsists ozone and sunlight and only in cold resistance is it classed as fair.

So there is a general summary of the way we look at some of these materials. We are not quite so optimistic as Crafton and Slade were. We do not know as much about it maybe as they do.

No. 3, p. 5: (Slide) Here is a sample of unquenched polythene, very thin, the same thickness as quenched material. We put it over a calendar to show the transparency. Over a long standing, this will slowly crystallize. After six months to a year, it will begin to get very, very hazy and eventually, I presume, go back to this (indicating) so that would explain why a number of polythene samples you might find are transparent on water and if you bring it out of the extruder and out of the crosshead and run it into cold water, you sometimes make it transparent so the wire can be seen instead. That is at least one explanation of it.

No. 4, p. 5: (Slide) If polythene is cold drawn, if it is put under tension, it necks down in this way. The tensile strength goes from around 1800 or 1900 up to probably 15,000. That is going to be very interesting in the manufacture of filaments.

I have a little piece of polythene here. It is 150 thousandths, I think, and you can actually stretch it, could draw it. Once you get it out cold drawn, then I will defy anybody to take that and break it from here (indicating). It really gets strong, so you see it is elongated and it is oriented and the tensile strength is increased almost tenfold.

That is very similar to nylon. We cold draw nylon and make the fibers and filaments which have tensile strength ranging in the undrawn form around 15,000 psi and in the drawn form, in the oriented form, about 60,000 psi. That is one interesting characteristic of crystalline plastics.

(Slide) This is simply the same magnification of the drawn material. You see the orientation of the spherulites.

(Slide) This is a stress strain curve which shows in graphical form just what I have shown here. You strain the material up to a point around what ordinarily would be its yield limit. In this sample, it happened to be a little under 1600. Then there is this portion where the elongation increases without any increase in stress. That is, the stress is constant and the elongation increases. When you get over here, the stress required to break it would go 'way up. We do not have it on that slide, but it would go up to about 15,000 psi.

(Slide) This is simply a polaroid examination of a sample which is under cold drawing stresses. It is above the yield limit and this is the portion that is beginning to be cold drawn and that is the undrawn portion.

No. 5, p. 5: This ties right in with that question that was asked about what is going to happen after the war when you get a lot of modifications. Here are any number of them (slide) which all have different properties, so we are going to be able to tailor-make your resins for installation, we believe, to suit your needs. In other words, if you call for one certain property you want magnified over another, by the use of various modifiers, we will be able, we hope, to give you what you want.

This simply shows some of the resins we have used: Cumar—this is an RG-3 resin. I am not sure of the manufacturer of that. This just shows various resins and rigidity. The low reading indicates better, stiffer material. Paraffin, micro necks black (reading from slide). That shows the change of one property with modification.

We will be able to offer you polythene in colors, in any of the N.E.M.A. colors. We believe that we can offer any special colors by modification of one particular property.

No. 6, p. 6: This is the compatibility of polythene with certain modifiers, compatible in all proportions—raw natural rubber, gutta percha, and so forth (reading from slide).

No. 7, p. 6: When it was put into the hopper and dropped down in the injection molding chamber, the nylon was too fluid. Nylon has a very sharp melting point and above that melting point, it is almost a liquid, so we had to modify. (Slide) In this section right at the orifice where the material flows into the die, we put a modification.

(Slide) This is a shutoff nozzle which when the die is brought up against here, this portion is pushed back so the material can flow in through these channels.

(Slide) The simplest arrangement, however, was a screen pack. I think these are simply 60 mesh screens, packed in here to keep the material from dripping out the nozzle when the die is pulled away.

Before we get on to extrusion, I will mention a couple of things about injection molding nylon since the switchette sets have been brought up. I have two or three small pieces here. I think you will be able to see them.

This is the famous switchette which GE made and about which there has been a great deal of publicity. That is simply a small molded nylon box and into that goes the mechanism for the switch.

I was able to obtain a little larger one. This is another one, molded nylon switchette box. As far as the properties of these materials, nylon is particularly noted for its high impact strength and its resistance to wear.

I will show you a couple of other things. We molded some tumblers out of nylon and also some plates. These plates and tumblers are of particular interest because the aircraft people want something light and they want something that will not break. They want something that can be sterilized. We think that probably after further development, we will be able to give the whole set of dishes of nylon.

One particular advantage of this is that you can bang it down on the floor and nothing happens (demonstrating). Nylon is a very tough material and in hotels, for example, where the breakage is terrific, I think they are going to be interested in that sort of thing.

No. 8, p. 8: We are trying to give the electrical people a nylon with very low water absorption and we think we are on the right track, so that criticism, I think, can be soft pedaled a little bit now.

No. 9, p. 8: (Slide) These are some of the properties of nylon and this is the molded variety. I mentioned in the preprint of this article that we were getting together other properties which I would present here, but the slides that were made for this were somewhere btween the slide manufacturer and the Arlington plant when I left yesterday, so I was not able to pick them up. However, I will mention a few here.

The specific gravity of the extrusion type is still lower. It is 1.085. I will pick out a few other things. The tensile strength is a little lower than that given there for 77° and that is 70,000 psi. We have had to drop a little bit to sacrifice there. Elongation is about 285 per cent instead of 54 per cent. I do not have any of the other electrical properties which would be of interest. Incidentally, there are no solubles in the water absorption test in nylon.

(Slide) The flow temperature of the thermal properties of this extrusion grade of nylon are somewhat less than those of this molding grade. That is, we have had to sacrifice some of the thermal properties, but you still have excellent heat resistance in the nylon formulation for extrusion. The water absorption which I do not have on this slide is 1.5 on the molded variety and it was .5 on the new extruded type, so you see we have cut that down considerably.

(Slide) This is simply a slide which I used to use when discussing molded nylon and people began talking about the high water absorption of it, which at that time was reputed to be 7 per cent. It is 7 per cent under water after long exposure of 50 to 60 hours. Nylon will take up water. Its impact strength is tremendously increased. Its flexural strength is decreased when it has that much water in it; but on aging, if you take it out of the water, the material is not impaired and will retain its properties according to these curves as it loses the water in 50 per cent relative humidity.

It conditions itself, as it were, whether it is submerged in water or in a 50 per cent relative humidity, as here and here (indicating) you see the water absorption at the test value of 50 per cent relative humidity is a little over 1 per cent.

(Slide) This simply shows how rapidly the impact strength of nylon goes up as the moisture content is raised.

With regard to the future of polythene and nylon, I think as far as wire coating is concerned that is pretty much up to the wire manufacturers as to just what they want the raw material manufacturer to give them. Our experience in wire coating has been very meager. That is, we are just getting into the thing with polythene.

We are rapidly expanding our knowledge of wire coating materials. We have an outstanding testing laboratory. I do believe I can really say something for our testing laboratory. We are planning to be a big producer of wire coating compounds. We feel we are to have a number of others besides polythene and nylon for jacketing, neoprene as produced by our organic chemicals division.

The main point I want to bring out is that unless the wire manufacturers give us an indication of what they want in a wire coating, we are going to have to go on on our own, and probably somewhat slower than otherwise. We have had comments from a large number of the wire people as to just what they want in a wire compound and we are very optimistic about being able to give them that.

We have other materials in the research laboratory which are very interesting. Polythene, as I say, can be modified greatly and nylon, we feel, because of its toughness and resiliency and heat resistance, resistance to flame, is going to be an excellent jacket on small wires where you want a thin, tough, flexible coat.

Radio hookup wire was mentioned just a minute ago, Mr. Rolston. The Signal Corps has recently authorized the use of nylon on radio hookup wire and so far as that soldering test is concerned, that was brought up when I was at one of the manufacturers. They checked it out and find that due to the high heat resistance of the nylon, you do not get nearly as much flow as you do with most thermoplastic resins. Therefore as you apply your solder, you do not get that flow of the thermoplastic down over your soldering, so they seem to feel in that particular company that nylon has its advantages along that line. It is fungus resistant and that is the point the Signal Corps liked more than anything else.

I think that is about all I have to say. I will welcome any questions and I hope I will be able to answer them for you.

The Chairman: Does anyone have any questions?

A Member: You say this cold drawn polyethylene approaches 60,000 pounds psi?

Dr. Shackleton: No, cold drawn nylon. Cold drawn polythene is about 15,000.

A Member: Are you making fibers now out of nylon for strength work?

Dr. Shackleton: With nylon, yes. The plastics department at Arlington makes the filaments, monofilaments. The nylon division at Wilmington would handle the multifilaments for fabrics, so we do make fibers. We make monofilaments for such things as sutures and we will in peacetime for tennis racquets, toothbrush bristles, and all that sort of thing. We make the monofilaments which are cold drawn.

A Member: How does that compare to the strength on those cold drawn fibers with the rayon fibers?

Dr. Shackleton: I am not certain. Rayon has a number of high strength fibers. I have not kept very close touch with that, so I cannot give you the figures. I understand that nylon is much stronger than rayon, but polythene is not as strong as rayon, both speaking of the cold drawn state.

Mr. Rolston: How about the flexibility of the cold drawn polyethylene? In other words, if you were to draw a filament, what would be its low temperature flexibility or even at room temperature?

Dr. Shackleton: I cannot answer that definitely, but I think it is the same. I did

not pick up that information definitely, but I think it is the same as the undrawn, run the same range.

Mr. Rolston: Then I would like to ask you on this radio hookup wire, were you referring to a wire in which an extruded nylon was the primary insulation?

Dr. Shackleton: No, that is a jacket on the primary insulation. In other words, it seemed that the Signal Corps wanted something to replace cotton braiding and the cotton braiding was used as much for identification as anything else, so they found that with various modifications in the nylon we could get the identification they wanted. In that the material could be extruded on rather than braided, they felt that was an advantage in production.

Mr. Rolston: Then would the conclusion be drawn that if you had under that a primary insulation of some extruded type, then you extruded a thin covering of nylon over that, if the underlying insulation, we will say, was another thermoplastic, that would indicate on this soldering job that because of the presence of the nylon coating you prevented the flow of the underlying insulation down over the solder?

Dr. Shackleton: That is the way it seemed to work. I am not sure what the insulation was. I believe it was a rubber base insulation, but I cannot say definitely.

We have done the same thing with polythene insulated wire with nylon jacket. There is one question that has always been in my mind, if the speaker would be allowed to ask a question of the audience. I have always wondered—and I would like an answer from the wire people—if you have a material such as polyethylene with a very, very low water absorption, what would be the big disadvantage of a jacket which had a relatively high water absorption? In other words, your insulation is not impaired by water at all and so would there be any big disadvantage in your having a water in your jacket, assuming that it is down around .5?

Mr. Rolston: I think in many fields the answer would be no, that there would not be a great deal of difference; but going back to this particular type of work you are speaking of, if you would have creep resistance—in other words, if moisture was picked up in the outer nylon covering —then you would have a leakage path where the connection is made and get surface creepage. On high frequency work, that would be quite a serious thing.

Dr. Shackleton: That answers me. That is the first time I have ever heard a reply like that that really has definitely answered it.

The Chairman: Does anyone else have any other remarks on that specific question?

Maybe some of the gentlemen would like to know on the handling of polyethylene if there is any basic difference in the equipment as compared to handling of vinylite and koroseal?

Dr. Shackleton: No. Starting with the machine itself, any plastic extruder will handle polyethylene and extrude very nicely, softens all right. Then when you get to the dies, that is quite a controversial point. We have been reluctant to make any recommendation as to dies because we have found that one company will use one die setup that is completely different to the other and get the same results and swear that is the only way to do it.

We have tried various die setups in our machines and have not been able to check the experience of some of the wire coaters and other wire coaters could check it, so the thing seems to be pretty much of an undecided point.

There have been a number of recommendations for dies for specific wire, but I do not know that in any of these cases there are other operators that are using different die setups and having just as good results, so I am a little backward in saying anything about dies.

As far as the cooling is concerned, on small wires, a water trough about 20 feet long would be recommended. Cooling in air on very, very thin coatings has been carried out. However, at high speeds — and we will say with a wall thickness of around .012 or .014 and above—you probably should run it into cold water. If your wall thickness rises and you begin to run faster, longer cooling troughs are recommended.

In cases where you are extruding an insulation an eighth of an inch or above, let's say, it would be recommended to have hot water maybe at 160°F. in the first 30 feet of a 50-foot cooling trough and then maybe cold water in the remainder.

Those are the outstanding differences. They are not serious. Of course, some extruders are set up right against a wall and you have no place to put the trough unless you cut a hole in the wall and put it outside, but you really do not need any special setups, particularly.

With the extrusion of nylon, we had a die developed, a simple tubing die which is self-centering. It has channels down the flow part of the die for the very liquid nylon to flow. We have used it on polythene and it works very well. It is simply a self-centering tubing die which pulls down a tube of the plastic over the wire and the thickness of the coating is determined by the speed of your extrusion.

We have laid on nylon coatings seven-thousandths thick on about an overall 40 mg. wire at a rate above 1000 feet a minute —that is on a number one Royal machine —so that particular die is applicable to certain jobs.

There is much work to be done on dies and on tips and dies for extrusion of polythene and nylon as well.

The Chairman: Has much work been done on the application of nylon immersed in solvent?

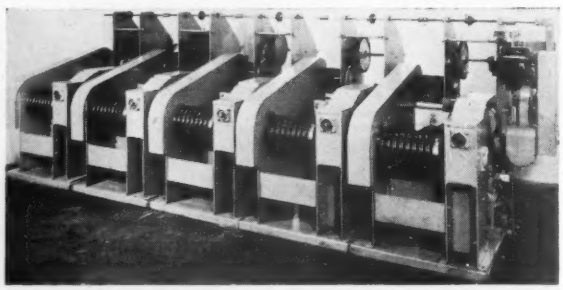
Dr. Shackleton: Yes, we have two varieties for that. As a matter of fact, there has been a lot of wire coating done using nylon solutions. We have had to develop soluble type nylons. The fibrous type nylon and the molding powder nylon are insoluble in almost all solvents, maybe with the exception of the phenols, and so it took some development to make a soluble nylon which would dissolve.

We make it up in alcohol solutions and that has been tested out. I do not know how far that development has really gone for solution coatings, dip coatings.

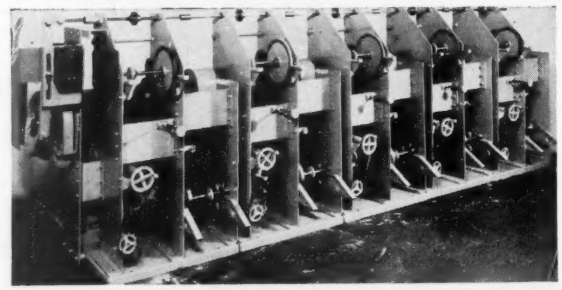
A Member: Talking about a nylon jacket, I am a little bit confused on this cold drawn proposition. For instance, if you had a jacket on a cable ½ to ¾ inch in diameter and the cable is bent sharply, this stretching would then produce elongation and there is apparently no recovery. Would that result in a horny ridge?

Dr. Shackleton: I thought I brought a sample of that with me. I wanted to show it to you. The first samples we submitted to the Navy for a special job looked fine when they left our plant, but one of those Navy men who was sitting in a meeting had it in his hands and with nothing else to do, he was twisting it back and forth. Pretty soon there was a collar of nylon

OVEN SIDE



OPERATOR SIDE



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all around it and it turned out a very interesting fact. When we tried to break that nylon, you could not break it—it was so tough—but underneath the stress concentration at that neck, it had split the metal braid and wore it out.

We went back to the plant and studied it a while and found out finally that if you put on a very thin coating of nylon, which is an advantage in saving material and you still have your abrasion resistance, you get away from nearly all of that.

There is a slight tendency for it yet. As you cold draw it over the periphery of the outside part of the curve and you bring it back, there is no recovery, so it sits up there in a little hump; but on the thin coatings we have gotten away from that pretty well and it does not seem to be too much of a disadvantage now. It might be in certain cases, I do not know.

The Chairman: Dr. Shackleton has quite a number of samples of some of the materials that were discussed here and I think he would welcome the chance to let anyone see them. They will be up here at the table, so unless you have something further to say we will close the meeting. I think we should also give Dr. Shackleton a round of thanks for his very interesting paper. (Applause)

Session, Thursday, October 19, 1944—1:30 P. M.

Chairman of Meeting

H. W. Anderson, President
Fidelity Machine Co.,
Philadelphia, Pa.

PAPER: "Covering Weatherproof Cable"

H. Kaffine,
Chief Mech. Engr.,
Fidelity Machine Company,
Philadelphia, Pa.

The meeting reconvened at two o'clock, Mr. H. W. Anderson presiding.

The Chairman: This afternoon we were to have two papers. The program indicates that Mr. H. Kaffine, the Chief Mechanical Engineer at the Fidelity Machine Company, would submit a paper. There has been a substitution there due to causes beyond control, and Mr. Robert Harbeck of the Fidelity Machine Company will give his report on, "Covering Weatherproof Cable."

Mr. Russ Jordan of Ault and Wiborg in Cincinnati who was going to talk on, "Lacquers and Saturants," has not been located. If he does not put in an appearance before we finish, after questions have been submitted, we will close the afternoon at that time.

I am pleased to present at this time Mr. Robert M. Harbeck.

(Mr. Robert M. Harbeck presented his prepared paper.) (Applause)

The Chairman: Are there any questions?

A Member: I would like to ask whether or not this works equally well on single-ply as well as two-ply cottons?

Mr. Harbeck: Yes, it does work just as well on single ply and, in fact, it works better on the single ply than it does on the double ply, although it is perfectly practical to use either kind. The double ply yarn should be twisted together or the needles will occasionally grab only one of the strands.

The Chairman: I wonder if Mr. Jordan has arrived.

A Member: A wire was just received that he missed his train accommodations, so it looks as though his paper will not be presented.

The Chairman: You know, on the last afternoon of a very full week, that message probably does not sound as bad as it would if it happened on a Monday afternoon with two speakers.

I think it has been a very successful weekly meeting and apparently The Wire Association has accomplished something in coming away from the large group meetings in Cleveland. It will be interesting to see what procedure is followed next year.

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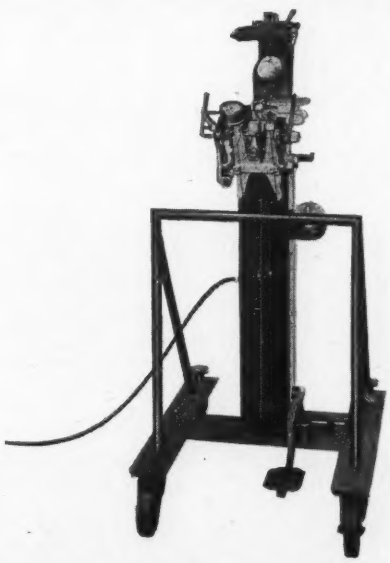

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Government Wire Production Information

Innerspring Mattresses

BEDDING Industry Advisory Committee members at their recent meeting said they expected production of innerspring mattresses under the "spot authorization" procedure (Priorities Regulation 25) to be negligible.

✦ ✦ ✦

FEW manufacturers have any high carbon steel wire or partially fabricated innerspring units for use in the production of innerspring mattresses, the committee said, and suitable wire is not available on the deferred (Z-1) allotments made to bedding manufacturers in this connection.

✦ ✦ ✦

WPB officials explained that the facilities and manpower needed to make high carbon, heat treated steel wire, 13 gauge and finer, for innerspring mattresses are more urgently needed to make steel wire for use in the manufacture of communications wire and wire rope for the Army and Navy. Communications wire is one of the twelve most critical military items, they said. It is doubtful whether any orders for wire for innerspring mattresses can be filled within the next six or nine months, unless Germany is defeated and war orders decline.

✦ ✦ ✦

Effort Made To Standardize Screw Threads

A report of Anglo-American-Canadian Conferences on Standardization of Screw Threads and Cylindrical Fits has been issued by the Combined Production and Resources Board, the War Production Board has announced. Copies are available from the Superintendent of Documents, Government Printing Office, Washington, D. C., and from various technical bodies. The report is being circulated in Britain by the Ministry of Production.

✦ ✦ ✦

DIFFERING specifications on screw threads and related items between the three countries have already meant an additional $100,000,000 in war production costs, according to CPRB, and have delayed production and repair of war goods. A

special meeting of the American Standards Association, the Society of Automotive Engineers and the American Society of Mechanical Engineers opened in New York City on Thursday, November 16, 1944, to point out the advantages of standard specifications to leading industrialists, both in war production and post-war trade.

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THE report covers conferences between engineers of the United States, Canada and Great Britain, which took place in New York City at the end of 1943 and in London in August and September, 1944, on the subject of United States and British standards for screw threads and limits and fits for engineering. These conferences were inaugurated by CPRB, which was established by the three countries in 1942 for the purpose of integrating their production programs. The first screw thread conference in New York was arranged by the American Standards Association at the request of CPRB, and the London conference was arranged by the British Standards Institution at the request of the British Ministry of Production.

✦ ✦ ✦

Refined Copper Stocks in U. S. Expected To Exceed 500,000 Tons at Year-End

MICHAEL SCHWARZ, Director of the W.P.B. Copper Division, in Issue No. 9 of the Requirements-Supply Position of Copper, reports that actual operations for the first three quarters of 1944 and, in addition to estimates for the year 1944, includes estimates for the first half of 1945.

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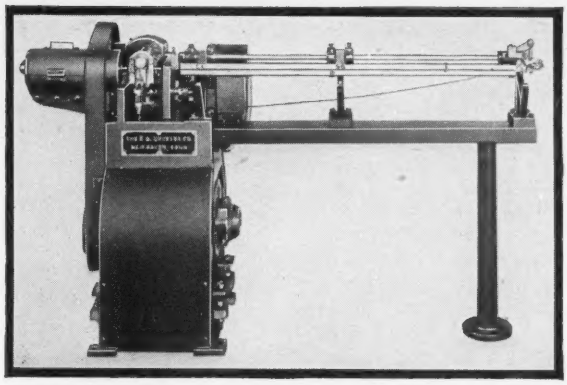
DURING the third quarter of 1944 there was a surplus of 60,100 tons of refined copper compared with a deficit of 2,300 tons during the previous quarter. The improvement resulted principally from a decrease in consumption of 69,900 tons (15%). For the fourth quarter, consumption is expected to increase to 404,200 tons which, with supply estimated at 428,000 tons, should result in a refined copper surplus of 23,800 tons for the period. It appears that at the end of 1944 total stocks of refined copper in the United States, including the government stockpile and working

(Please turn to Page 66)



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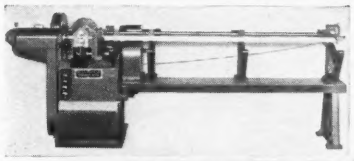

Type 1A
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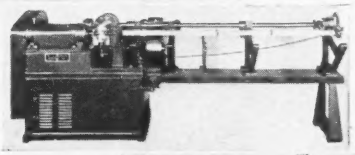

Type 2A
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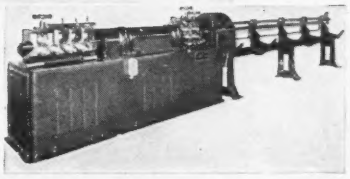
Type 3A
3/16" - 3/8" Dia.

Type 4A (not shown)
33/8" - 5/8" Dia.



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SHUSTER
Automatic
WIRE STRAIGHTENING
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MACHINES
Since 1866

Government Wire Production Information

(Continued from page 65)

stocks, will reach an amount somewhat in excess of 500,000 tons.

✦ ✦ ✦

CONSUMPTION of refined copper during the first and second quarters of 1945, in each case, is expected to approximate that of the fourth quarter of 1944. The supply in 1945 is expected to be augmented by about 50,000 tons per quarter of additional copper previously purchased by the British which will more than compensate for the estimated loss in domestic reduction due to manpower shortages. The estimated quarterly surplus is 43,700 tons. Supplies of unalloyed copper, red metal and refinery brass scrap are short. 70-30 mill scrap augmented by fired shells is in balance. There is a small surplus of rod turnings. Stocks of scrap dealers and processors are comparatively low.

✦ ✦ ✦

Status of Copper Products

PRODUCTION of copper products and alloy tubing reached an all-time high in October, it was disclosed at a recent meeting of the Brass Mill Industry Advisory Committee.

✦ ✦ ✦

BRASS mills in October produced 35,000,000 pounds of copper products and 30,000,000 pounds of alloy tubing, both record figures. On the other hand, the October output of 91,000,000 pounds of rods was described by WPB officials as "very good." Strip production, however, was "slightly off" with the output measuring 233,000,000 pounds. This was attributed to a downward adjustment of some ammunition programs.

✦ ✦ ✦

WPB officials said that November forecasts indicate that production during this month will compare favorably with the October figures. Both military and essential civilian requirements for brass mill products during the first and second quarters of 1945 are expected to continue at the present rate, or even higher unless there are major readjustments, officials declared.

Electrolytic Manganese Produced At Lower Cost Bureau of Mines Reports

EXTENSIVE research has made possible the production of virtually pure electrolytic manganese at lower cost, the Bureau of Mines revealed recently in making public a heretofore restricted report describing laboratory tests of the more important features embodied in its pilot plant at Boulder City, Nev., now capable of turning out more than 2,000 pounds of electrolytic manganese daily.

✦ ✦ ✦

ALTHOUGH the pilot plant at Boulder City was built for the express purpose of perfecting a Bureau-invented process for converting low-grade manganese ore into glistening metal 99.9%-plus pure, the product of the pilot plant has been used to replace nickel in the five cent coin and in other important war applications, both in the United States and England.

✦ ✦ ✦

MOST of the metal being produced in the pilot plant today is being

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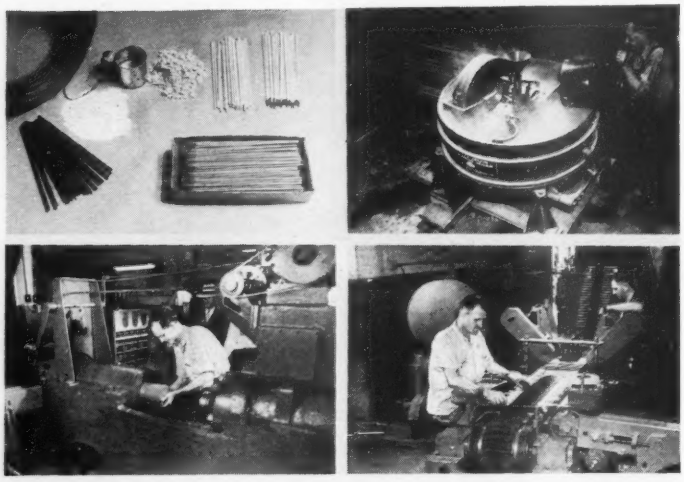

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tested in cooperation with industrial firms to determine its usefulness and possible advantages in applications where other forms of manganese now are employed.

✦ ✦ ✦

A copy of the publication, Report of Investigations 3681, "Manganese Investigations—No. 19, Studies in the Electrodeposition of Manganese," may be obtained free from the Bureau of Mines, Department of the Interior, Washington 25, D. C.

✦ ✦ ✦

Fine Resistance Wire, The Smallest Component of War

FINE resistance wire, made of 80 per cent nickel and 20 per cent chromium, is a modern triumph of cooperation between industry and the United States Army Signal Corps. It is being used in communications equipment in the hottest battles, yet it is considered to be "the smallest component of war." The diameter of this wire is as small as .0008 of an inch, which is about one-fourth the diameter of an average human hair. For purposes of insulation, it is treated with three to six coats of enamel, which is baked on in successive operations.

✦ ✦ ✦

IT is a fact—though hard to believe—that ninety miles of wire, and that is 475,000 feet, can be produced from a single pound of the nickel and chromium alloy mentioned. A ton of the alloy would provide approximately 200,000 miles of wire. Its high tensile strength makes such fine drawing possible. Copper, with less tensile strength, would snap before such fineness could be reached.

✦ ✦ ✦

THE finest-drawn nickel and chromium wire is used for precision-type resistors of certain radios. It will handle up to two watts in radio receivers and has a resistance of 650 ohms per circular mil foot. Inspection limits for the wire permit a variation of one half of one degree of resistance.

✦ ✦ ✦

SEVERAL manufacturing concerns in different sections of the country are already producing wire of this alloy, and the output will be stepped up substantially as new uses for it are developed. The smallest component of war represents another forward step in the Signal Corps' constant battle to produce better instruments of war with less critical material in fewer hours of labor.

THE 1945 CONVENTION OF THE WIRE ASSOCIATION WILL BE HELD AT CHICAGO OCTOBER 15-19, 1945

✦ ✦ ✦

Issues New Technical Data Sheets

AMERICAN Chemical Paint Co., Ambler, Pa., have published as follows: No. 13-14-2-2, on the subject of the removal of coatings of copper and lead from basic metals, such as steel, nickel, chromium and aluminum; No. 14-6-70-3, on the ACP alkali cleaning process using **Ridosol** #70 and Ridoline #30; No. 3-2-210-2, on Deoxidine No. 210 for spray application (a steel cleaner and conditioner for preparation for painting); and No. 11-5-3-2, on Peroline #3, a rust preventive for storage or transit.

✦ ✦ ✦

THE data sheets contain complete instructions on when and how to use these products, what equipment is required, and information as to in what form it is shipped.

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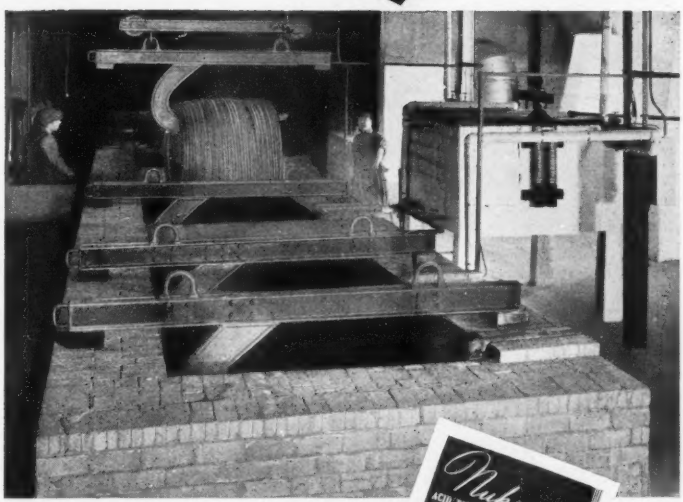
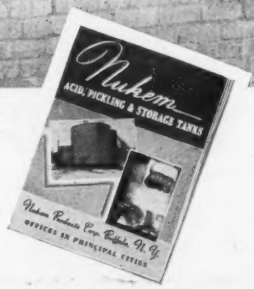
Write for illustrated literature describing BASOLIT Pickling Tank Construction and its advantages in your plant. If desired, we will furnish the labor as well as the materials on any installation.





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A Review of Recent Wire Patents

No. 2,361,961, UNIVERSAL CUTTING MACHINE, patented November 7, 1944 by Harvey E. Pruitt, Flint, Mich., assignor by mesne assignments to Emery M. Rice, Hanna, Ind.

More specifically, this is a bar cutting machine with special provisions made to prevent undesired longitudinal and transverse movement of the bar during the severing operation.

✦ ✦ ✦

No. 2,362,073, WIRE DRAWING, patented November 7, 1944 by Charles D. Johnson, Worcester, Mass., assignor to Johnson Steel & Wire Company, Inc., Worcester, Mass., a corporation of Massachusetts.

Provision is made of a device, responsive to changes in the temperature of the heated circulating fluid to maintain the temperature thereof within a predetermined temperature range which is best suited for the wire-drawing operation regardless of the amount of heat generated by the drawing of the wire through the die or the heat loss from the die due to radiation.

✦ ✦ ✦

No. 2,362,179, METHOD OF WINDING COILS, patented November 7, 1944 by Karl H. Weber, Toledo, Ohio.

This method of winding coils in layers on a spindle from a continuous wire strand, comprises rotating the spindle with an end of the strand attached thereto, whereby the wire strand is wound in turns about the spindle, and forming an enlarged elongated closed loop in the wire strand surrounding the spindle adjacent the turn being wound, so that the portion of the strand just being wound is positioned between the last wound turn and the loop and in touching relations with both.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents; outside United States and Canada, $1.00. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.

✦ ✦ ✦

No. 2,362,284, METAL CLEANING COMPOSITIONS, patented November 7, 1944, by Louis McDonald, New York, N. Y.

For the removal of oxides, tarnish or scale, the inventor provides a composition, by weight of:

	Parts
Bentonite	10 to 30
Glucono delta-lactone	10 to 20
Wetting agent	about 2

admixed with tripoli and infusorial earth, each of the latter in substantial proportions to make up a total of 100 parts.

✦ ✦ ✦

Re. 22567, MECHANISM FOR CUTTING AND LOOPING SPRINGS, patented November 21, 1944 by Carl G. Hicks, Chicago, Ill., assignor to Maurice T. Williams and Ralph E. Williams.

There are 25 claims in this patent for a machine for cutting lengths of coiled wire into separate bodies, flexing the last two convolutions of each of the severed ends and crimping these convolutions.

✦ ✦ ✦

No. 2,362,969, EXPANSION NAIL OR THE LIKE, patented November 21, 1944 by Rudolph G. Boelter, Chicago, Ill.

This is a two-part type expansion nail each part having a part head, one part adapted to be driven ahead of the other and then the latter driven so that the heads are in the same plane.

✦ ✦ ✦

No. 2,362,999, SCREWHEAD, patented November 21, 1944 by Elmer Spencer Hewitt, Wilmette, Ill.

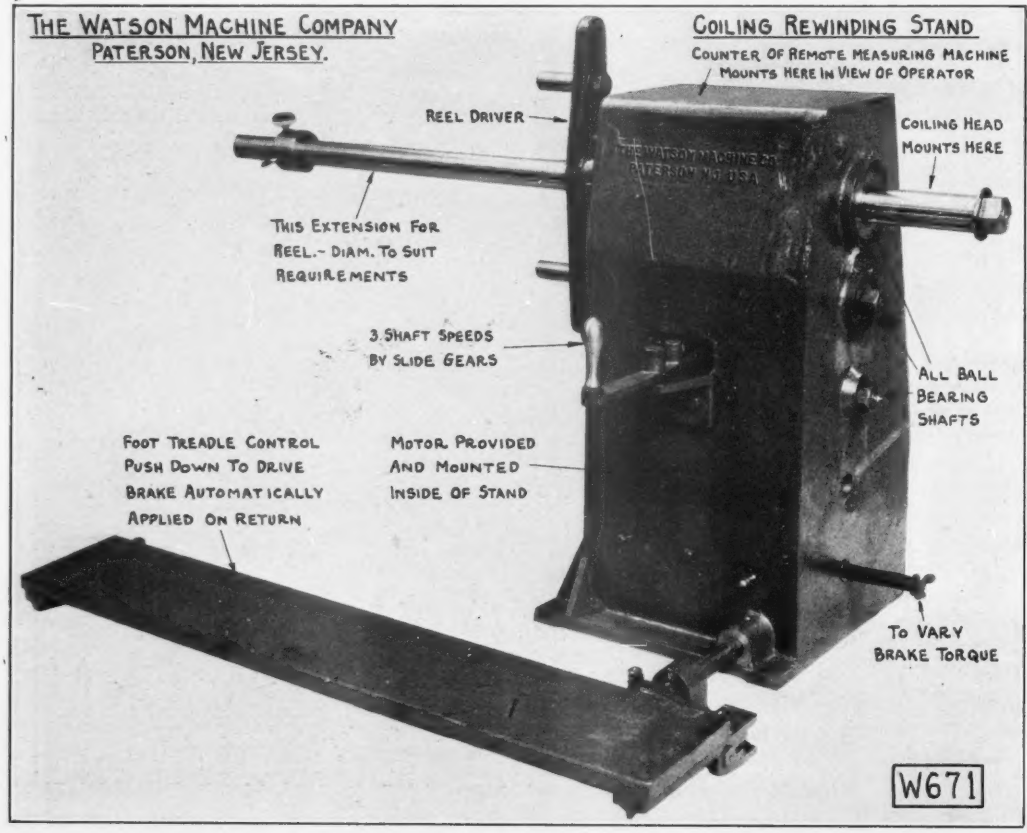
In the head is an axial socket bounded by an endless wall extending circularly through more than 180° and elsewhere non-circularly to define a lateral recess disposed eccentrically of the screw head.

✦ ✦ ✦

No. 2,363,406, ENCASEMENT FOR WIRE DRAWING DIES, patented November 21, 1944 by Otis G. Ferrier, Fort Wayne, Ind.

The chambered, solid metal block contains a refractory member encompassed by an encasement of initially pulverent metal similar in character to that of which the solid metal block is composed, the inner wall of said block being reshaped to form annular ledges that respectively underlie and overlie the rim of the member

THE WATSON MACHINE COMPANY
PATERSON, NEW JERSEY, U.S.A.


THE WATSON MACHINE COMPANY
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COILING REWINDING STAND
COUNTER OF REMOTE MEASURING MACHINE MOUNTS HERE IN VIEW OF OPERATOR
REEL DRIVER
COILING HEAD MOUNTS HERE
THIS EXTENSION FOR REEL.-DIAM. TO SUIT REQUIREMENTS
3 SHAFT SPEEDS BY SLIDE GEARS
ALL BALL BEARING SHAFTS
FOOT TREADLE CONTROL PUSH DOWN TO DRIVE BRAKE AUTOMATICALLY APPLIED ON RETURN
MOTOR PROVIDED AND MOUNTED INSIDE OF STAND
TO VARY BRAKE TORQUE
W671

THESE UNITS ARE WIDELY EMPLOYED IN WAREHOUSES AND SHIPPING ROOMS AND COMBINE REELING AND COILING IN A MINIMUM OF SPACE.

* * *

HEAT TREATED ALLOY SHAFT OF LENGTH TO SUIT AND DIAMETER TO 2⅜", 28" FROM FLOOR.

* * *

1 H.P. MOTOR

* * *

SPEED RANGES:
31 - 54 - 108
or
45 - 98 - 137
R.P.M.

* * *

LITERATURE ON REQUEST.

and adjacent portions of the encasement that confine the member and the encasement in a definite position in the block.

✦ ✦ ✦

No. 2,363,736, STAINLESS STEEL PROCESS, patented November 28, 1944 by John N. Lynn, Towson, Md., assignor to Rustless Iron and Steel Corporation, Baltimore, Md., a corporation of Delaware.

In preparing for cold-working a previously hot-worked hypereutectoid stainless steel containing at least 16% chromium and 0.75% carbon which is hardenable by heat-treatment, the process includes, quench-hardening the same from a temperature of 1800°F. to 1925°F., and then annealing the hardened metal at a temperature of 1500°F. to 1600°F.

✦ ✦ ✦

No. 2,363,789, WIRE COIL INSERT, patented November 28, 1944 to Otto Haas, Richmond Hill, N. Y., assignor to Aircraft Screw Products Company, Inc., Long Island City, N. Y., a corporation of New York.

This is an insert for a screw connection and comprises a substantially cylindrical wire coil, one end convolution of this coil being provided with a recess on its inner side near its free end, the recess having a depth of approximately half the wire thickness and having a substantially radial flank adjacent to the free end so as to form a hook for the engagement of a torque-applying tool.

✦ ✦ ✦

No. 2,363,871, METHOD OF MAKING ELECTRICAL CONDUCTORS, patented November 28, 1944 by Alexis W. Keen, Packanack Lake, and Raymond B. Frost, Rutherford, N. J., assignors to United States Rubber Company, New York, N. Y., a corporation of New Jersey.

The method consists in winding yarn helically about an electrical conductor to form a serving having the strands thereof lying closely side by side, raising fibers of the serving by an air blast, pressing these raised fibers over the next adjacent strand at a definite angle thereto, and firmly securing the fibers in this relation by an adhesive to hold the strands together.

✦ ✦ ✦

Thin Steel Wire Used for Recording Sound

SOUND recording upon thin steel wire has been adopted widely during the current war and may find many uses in the postwar era.

✦ ✦ ✦

UNDER one method of recording, sound waves picked up by a microphone are fed into a recorder where they are converted into electrical impulses which operate a recording electromagnet. The impulses guide the magnet in such a way as to form a magnetic pattern on the wire. When the recording is finished, the wire can be run through a "recording head" which converts the electrical impulses from the magnetic pattern on the wire into sound waves.

✦ ✦ ✦

MEDIUM or hard carbon steel wire in very small diameters can be employed. The wire is almost indestructible. It can be played many thousands of times without distortion of the sound.

✦ ✦ ✦

WARTIME uses for this method of recording include the picking up of battlefield sounds, accounts of combat operations and reports from reconnaissance pilots.

✦ ✦ ✦

AS long ago as 1898 a Danish physicist used wire for recording signals. Later, flat steel tape recorders were employed.

J. O. Ross Engineering Corporation Elects New Director

ALLEN R. COBB, Vice President of the Irving Trust Company of New York has been elected to the Board of Directors of Ross Industries Corporation of New Brunswick, New Jersey whose fully owned subsidiaries are the J. O. Ross Engineering Corporation of New York, Chicago, Detroit, Boston and Ross Engineering of Canada Ltd. of Montreal.

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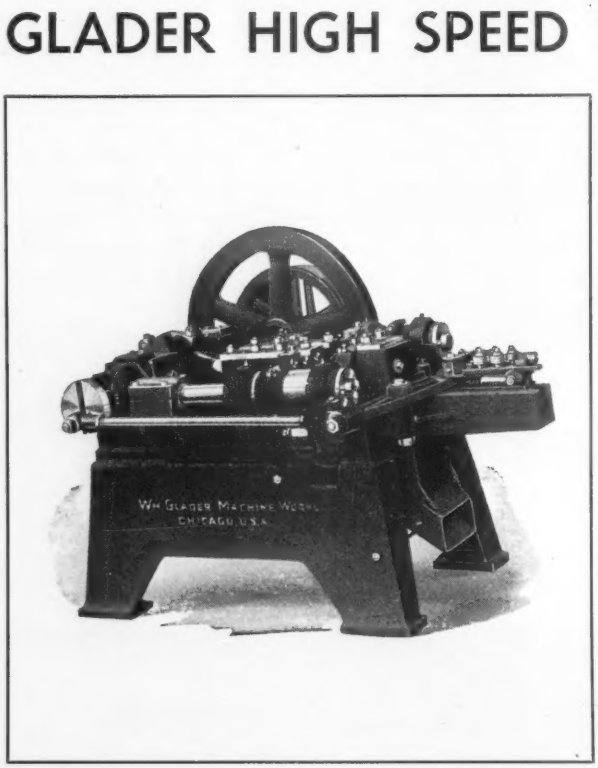

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(Please turn to page 72)

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Pittsburgh, October, 1944

(Continued from Page 71)

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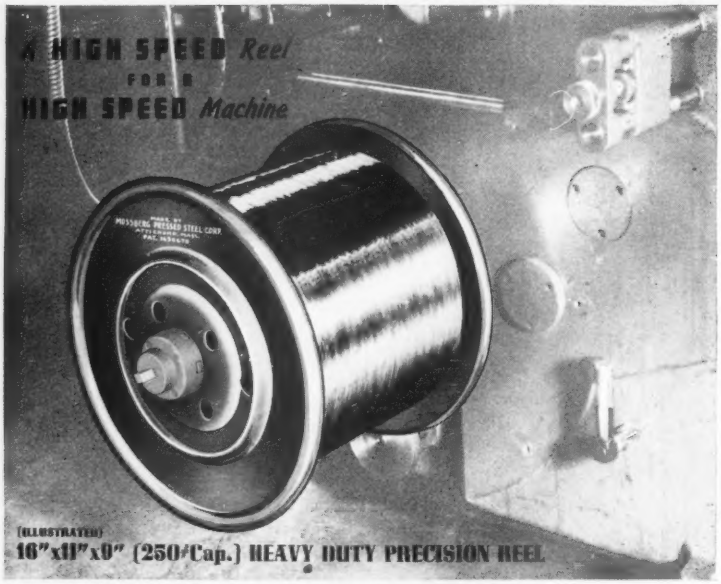

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OFFERS: BALANCED PRECISION REELS

in HEAVY DUTY construction for use on modern HIGH SPEED wire drawing machines.

To provide higher operating efficiency, with the ever increasing tendency towards the drawing of finer gauge wire on larger reels at higher speeds, the following reel requirements are now essential:

(1) PROPER PROPORTION
(2) BALANCE
(3) ACCURACY
(4) STRENGTH
(5) DURABILITY

All these requirements are incorporated in spools & reels made by

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Youngstown, Ohio.

LABEKA, CHARLES, Plt. Met.,
Pittsburgh Steel Co.,
Monessen, Pa.

LARSON, E. V., Repr.,
A. R. Williams Mchy. Co.,
Toronto, Canada.

LAUER, MAX W., Salesman,
Ajax Industrial Supplies Co.,
Fort Wayne, Ind.

LENHART, J. C., Supt. C. Drawn Dept.,
International Nickel Company,
Huntington, W. Va.

LEONARD, J. P., Sales,
Swift & Company,
Pittsburgh, Pa.

LEVI, D. B., Chem.,
North American Philips Company,
Dobbs Ferry, N. Y.

LEWIS, KENNETH B.,
Consulting Engineer,
Worcester, Mass.

LIU, K., Director,
Tze-Ho Iron & Steel Co.,
Nat'l. Resources Comm. of China,
New York, N. Y.

LONGWELL, JAMES R., Director of Fty. Research,
Carboloy Company, Inc.,
Detroit, Mich.

LUCAS, R. T., Service Engr.,
Vascoloy Ramet Corp.,
North Chicago, Illinois.

LUNDGREN, LIONEL O., Supt.,
Kennecott Wire & Cable Co.,
Phillipsdale, R. I.

LYONS, ERNEST H., JR., Chemist,
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McAULIFFE, F. L., Co. Repr.,
General Electric Co.,
Schenectady, N. Y.

McBRIDE, V., Engr.,
National Electric Products Corp.,
Pittsburgh, Pa.

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Wickwire Spencer Steel Company,
Buffalo, N. Y.

McCOY, A. W., JR.,
Firth-Sterling Steel Co.,
McKeesport, Pa.

McFARLANE, EVAN P., Mgr.,
Bethel Machine Company,
Danbury, Conn.

McGOWAN, C. L., Supt. Wire Mills,
Atlantic Steel Company,
Atlanta, Ga.

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Apco Mossberg Company,
Attleboro, Mass.

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Cuyahoga Falls, Ohio.

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John A. Roebling's Sons Co.,
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MARKLEY, W. F., Asst. Lines Engr.,
Western Union Telegraph Company,
New York, N. Y.

MAW, J. L., Wks. Mgr.,
The B. Greening Wire Co., Ltd.,
Hamilton, Ont, Canada.

MAY, G. L., Asst to Pres.,
Micro Products Company,
Chicago, Illinois.

MEALS, C. D., Chf. Engr.,
Bethlehem Steel Company,
Williamsport, Pa.

MELVILLE, NORMAN J., Deputy Chief,
Rod & Wire Branch,
War Production Board,
Washington, D. C.

MEYER F. W., Supt. Wire Mill,
W. S. Tyler Company
Cleveland, Ohio.

MILLER, H., Asst. Wks. Mgr.,
Northern Electric Company, Ltd.,
Montreal, Canada.

MILLER, R. V., President,
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Wire Rope Division,
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MORGAN, WELD, Engr.,
Morgan Construction Co.,
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MORITZ, JOHN A., Supt. Wire Mills,
Keystone Steel & Wire Mills,
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MORITZ, JOHN, JR., Sales Engr.,
Firth-Sterling Steel Company,
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Stamford, Conn.

MORRIS, GEORGE L., Vice-Pres.,
Syncro Machine Company,
Perth Amboy, N. J.

MORRISON, JOHN R., President,
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American Steel & Wire Company,
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Canadian General Electric Co., Ltd.,
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Nehring Electrical Works,
DeKalb, Illinois.

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NICODEN, PAUL T., Asst. Works Mgr.,
Page Steel & Wire Co.,
Monessen, Pa.

NITCHIE, C. W., Firthaloy Engr.,
Firth-Sterling Steel Company,
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Keystone Steel & Wire Company,
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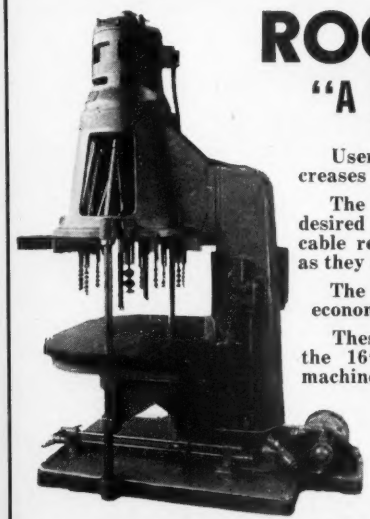
(Please turn to page 74)

ROOT CABLE REEL BORERS

"A Cable Reel Side Bored with Each Feed Stroke"



Root Style "AMH" 27" Round Hood Cable Reel Borer

Users of these borers report production increases up to 500%.

The adjustable spindles are centered for the desired pattern of holes. After that assembled cable reel sides will be accurately bored as fast as they can be handled into and out of the machine.

The hydraulic table feed assures unsurpassed economy of production and maintenance.

These borers are built in three sizes, the 16" diameter hood single column machine will handle cable reel sides up to 32", the 27" diameter hood single column machine up to 42" diameter and reels and the 40" diameter hood double column machine up to 84" capacity reel sides. Larger capacity machines built on order.

Root Style "AMRH" 40" Double Column Round Hood Cable Reel Borer.

Let Root solve your cable reel boring problems. Send us blueprints of your reel boring jobs.

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Wire Association Convention
Pittsburgh, October, 1944

(Continued from page 73)

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Bethlehem Steel Company
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Hy-Carbosteel Company,
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SEE, WALTER GEORGE, Chf. Engr.,
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SKEKEL, ALEX., Asst. Supt. Wire Mill,
Northwestern Steel & Wire Company,
Sterling, Illinois.

SLOOTMAKER, A. C., Sales,
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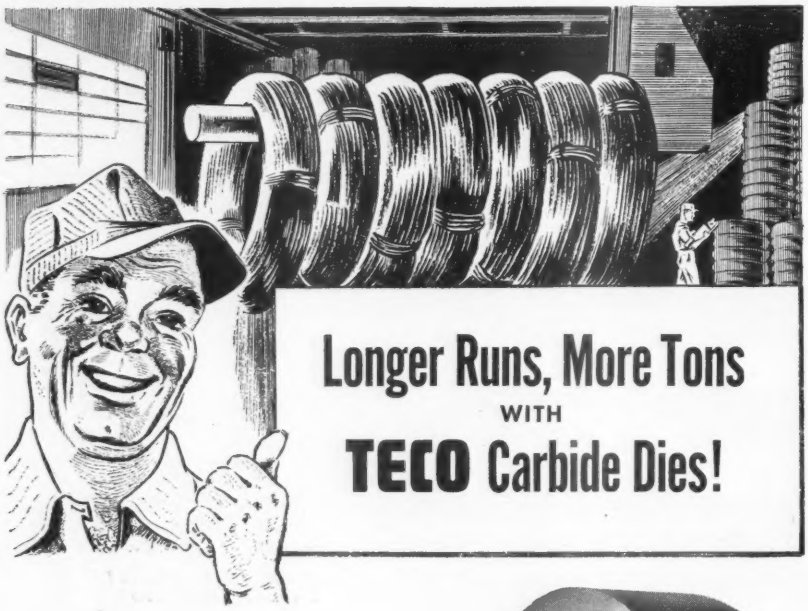
Chicago, Illinois.



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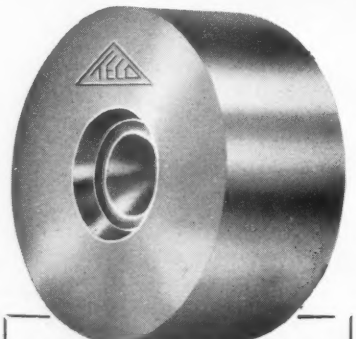

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STOUT, R. M., Sales Engr.,
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SULLIVAN, J. J.,
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SWEDBERG, LE ROY C., Supt.,
Midland Wire Corp.,
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SZILARD, J. A., Asst. to Res. Dir.,
General Cable Corp.,
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TATE, JOHN A., Foreman,
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TATNALL, R. R., Met. Engr.,
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Magnus Chemical Company,
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John A. Roebling's Sons Co.,
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VAUGHN, J. A., Secy.,
The Vaughn Machinery Company,
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VAUGHN, L. A., President,
The Vaughn Machinery Company,
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VICK, ARTHUR,
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VOICE, SIDNEY P., Exec. Vice Pres.,
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VOIGTLANDER, CURTIS, Supt. Wire Mill,
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WANG, CHIN-HSI, Asst. Wks. Mgr.,
Yunnan Iron & Steel Works, China,
New York, N. Y.

WARD, C. T., Supt. Rod & Wire,
Bethlehem Steel Company,
Johnston, Pa.

WAYMAN, F. G., Chemist,
Steel Company of Canada, Ltd.,
Montreal, Que., Canada.

WEIKEL, GEO. A.,
American Chemical Paint Company,
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WEISEL, E.,
Vaughn Machinery Company,
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WEISS, J. G., Foreman,
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WEYANT, R. K., Plt. Supt.,
Wilson Steel & Wire Company,
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Canadian Elevator Equipment,
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Lee Wilson Engr. Co.,
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WILLIAMS, ROBERT C., Chf. Chem.,
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Columbus, Ohio.

WILLIAMS, H. S., Sales Engr.,
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Cincinnati, Ohio.

WILLIS, ROSS E., Fld Serv. Repr.,
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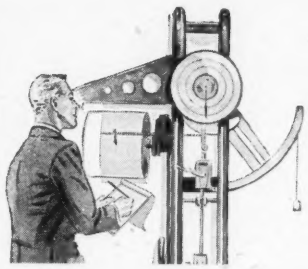

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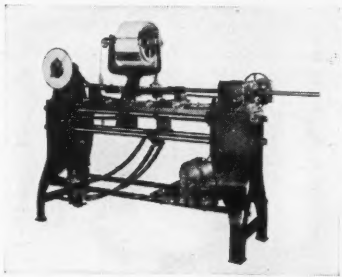

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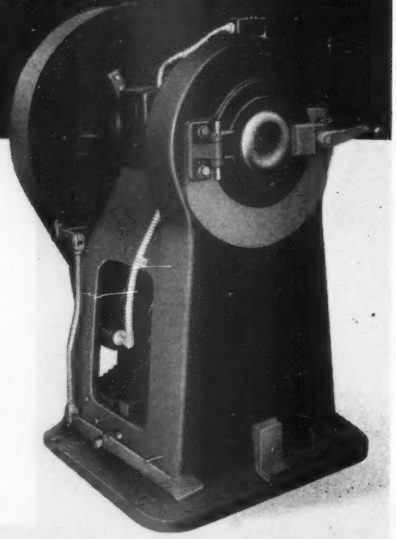

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Outstanding Personalities of the Wire Industry

ERNEST W. CLARK
Consulting Engineer
Syncro Machine Co., Perth Amboy, N. J.

ERNEST W. CLARK who has been associated with the General Electric Company in various capacities in the Wire and Cable Division since 1907, has been retired at his own request as of January 1st, 1945, and it is announced by the Syncro Machine Company of Perth Amboy, New Jersey, that on and after that date Mr. Clark will be associated with them in the capacity of consulting engineer.

E. W. CLARK
Consulting Engineer,
Syncro Machine Co.,
Perth Amboy, N. J.

E. W. CLARK was graduated from Yale University in 1901 and until he joined the staff of the General Electric Company in 1907 was associated with various companies in the Wire and Cable Industry in the field of design of wire and cable machinery as well as the manufacture of paper insulated cables. He also spent considerable time in Europe for the General Electric Company visiting cable plants in France, Italy, Germany, Belgium and England.

✦ ✦ ✦

MR. CLARK is a Director and Past Vice President of the Wire Association and is known to his many friends as being a highly competent wire man and a delightful personal acquaintance. He will be located at the main office of the Syncro Machine Company at Perth Amboy, N.J.

GEORGE L. MORRIS

Vice-President of Syncro Machine Company

MR. Morris was elected vice-president in charge of the Wire and Special Machinery Division of the Syncro Machine Company at a recent meeting of the board of directors held at their new plant at Perth Amboy, New Jersey.

✦ ✦ ✦

MR. Morris is well known throughout the wire industry through his activities as General Sales Manager of the Syncro Machine Company, which position he still holds in addition to assuming the duties of vice-president.

GEORGE L. MORRIS
Vice President
Syncro Machine Co.,
Perth Amboy, N. J.

✦ ✦ ✦

STARTING with the Elevator Supplies Company in 1924, Mr. Morris has a broad and intimate knowledge of the wire industry, obtained through working in all phases of the production, engineering and sales of this equipment. When the Syncro Machine Company absorbed the Elevator Supplies Company, Mr. Morris became General Sales Manager of Syncro. His headquarters will be at the executive offices of the Syncro Machine Company in their new plant at 611 Sayre Avenue, Perth Amboy, New Jersey.

✦ ✦ ✦

Prominent Machinery Manufacturer Dies

HENRY G. ELLIS, president of the Torrington Manufacturing Company, one of Torrington, Connecticut's most prominent citizens, died suddenly on December 2, 1944 at the age of fifty-nine.

✦ ✦ ✦

THE Company, well known in wire circles as manufacturers of spring coilers and other equipment for mills, suffers a genuine loss in the death of its president, who has been esteemed for his keen mind and understanding heart. There was hardly an important community activity with which he was not identified, his work outside of business contributing much to the development and improvement of Torrington, and his passing was a great shock to his fellow townsmen, by whom he was universally known and respected.

✦ ✦ ✦

MR. Ellis' many friends in the wire industry are sincerely sorry to learn of his death and extend their deep sympathy to his associates.

✦ ✦ ✦

Dr. Thomas Swinden Dies

DR. Thomas Swinden, Director of Research of the United Steel Companies, Ltd., Sheffield, England, died on October 27th, 1944, after a prolonged illness induced by the strain placed upon him by his war work. He was born in Sheffield on August 15, 1886.

✦ ✦ ✦

DR. Swinden was an outstanding metallurgist whose pioneer work with tungsten and molybdenum steel contributed much to the advancement of the knowledge and processing of these metals. He contributed many papers on various phases of steel production and was active in a large number of committees and societies having to do with steel metallurgy and war material production.

✦ ✦ ✦

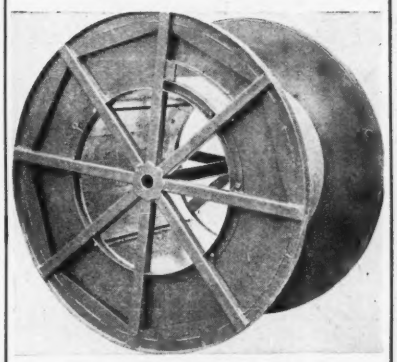
M. H. Corbin, Director and Vice President, Standard Varnish Works

M. H. CORBIN has been elected a director of the Standard Varnish Works, New York, and was appointed vice-president in charge of sales of both the New York and Chicago divisions. Mr. Corbin has been associated with Standard Varnish Works since 1937 and for the past two years he has been manager of industrial sales of the New York plant.

(Please turn to Page 78)

ALL STEEL REELS

FOR SHIPPING
FOR STORING
CABLE AND WIRE



Last Longer

Constructed of corrosion resisting materials, three to four times the life of a wooden reel is a reasonable expectancy.

Give Greater Protection

Smooth inner surfaces, much greater strength with the absence of all cutting or abrading projections — these protect not only the cable but the men handling it.

Save On Freight

Appreciably lighter than wooden reels — cost less to ship — a cumulative saving that more than offsets increased first cost.

Reduce Investment

The longer life of R. B. Hayward Steel reels reduces the investment in reel equipment.

Write for description of construction and prices.

R. B. HAYWARD CO.
1714 Sheffield Ave.
Chicago, Illinois

TUNGSTEN CARBIDE DIES
for HEADING and
WIRE AND TUBE DRAWING (.030" to 2"), EXTRUSION (1/16" to 1"), RECUTTING AND WELDING ELECTRODE COATING.

RING GAUGES
DIAMOND DIES (.0015" up)
DIAMOND POWDER IN ALL GRADES

AIRCRAFT EXTRUSION DIES

As a special service to customers, we are prepared to give three day service on standard wire, tube and extrusion dies in cases of extreme urgency.

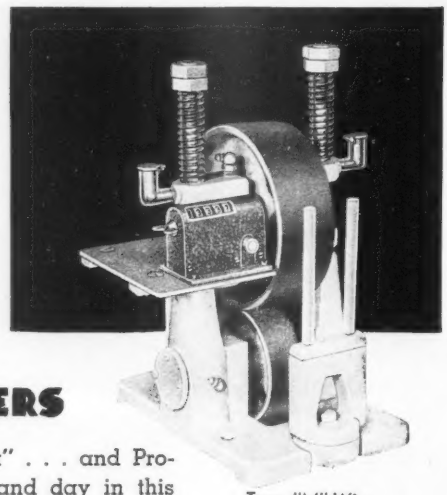
Address Inquiries to

MICHIGAN WIRE DIE CO.
11152 Chalmers Avenue
DETROIT 5, MICH.

Telephone:
PINGREE 5702

Speed Production for War Offense with

PRODUCTIMETERS



Type "M" Wire Measuring Unit

Winning the war is still a "first" . . . and Productimeters are working night and day in this vast program. For the wire industry they provide accurate count and control of production, one of the vital steps in getting materiel to the many battle fronts.

Are all your machines armed with Productimeters? If not, check now to see how to make them more efficient by the installation of Productimeter Measuring Units. The line is complete . . . with models applicable for various wire processes, and our Engineering Department is at your service to help with your counting problems.

Complete details in Catalog No. 3. Send for your copy today!

DURANT MANUFACTURING COMPANY
1918 N. Buffum St., Milwaukee 1, Wis. **PRODUCTIMETERS** 176 Eddy St., Providence 3, R. I.
THE SPEEDOMETERS OF INDUSTRY

Outstanding Personalities of the Wire Industry

(Continued from page 77)

Willis T. Cramer Becomes Assistant Director of Research of American Steel & Wire Co.

WILLIS T. CRAMER has been named assistant director of research of the American Steel & Wire Co., U. S. Steel subsidiary, succeeding Raleigh H. Barnes, deceased. Mr. Cramer has been promoted to his new position from the company's Cuyahoga Works where he has been works metallurgist since 1940.

WILLIS T. CRAMER

BORN in Columbus, Ohio, on October 28, 1907, Mr. Cramer first began his association with the Wire Company when he became an assistant in the physical laboratory at Newburgh Works, following his graduation from Ohio State University in June, 1929. In 1936 he was made head of the Newburgh physical laboratory and later that year was transferred to Cuyahoga Works. He held several other positions before his appointment in November, 1940, to the post he now relinquishes.

✦ ✦ ✦

New Du Pont Appointments

MR. H. R. Lounsbury, eastern trade sales manager, Finishes Division, E. I. du Pont de Nemours & Company, has been appointed refinish sales manager at the main offices here, it has been announced.

✦ ✦ ✦

R. E. Plowman, special assistant to the sales manager, will succeed Mr. Lounsbury in the Philadelphia, Pa., trade sales office.

J. W. Nestor, industrial sales manager at the Chicago regional Finishes office, is transferred to Wilmington as assistant to the industrial sales manager.

✦ ✦ ✦

J. L. Masterson, southwestern sales manager of the Finishes Division, E. I. du Pont de Nemours & Company, has been transferred to the main offices of the company at Wilmington, Del., and will be succeeded here by J. W. Cleaveland, assistant sales manager.

✦ ✦ ✦

Edgar Highley Superintendent of Dunkirk Mill, Allegheny-Ludlum Steel Corp.

EDGAR HIGHLEY, 63, superintendent of the Dunkirk wire mill of the Allegheny - Ludlum Steel Corp., Pittsburgh, died October 16. He was associated with the Jones & Laughlin Steel Corp. for many years before going to Dunkirk to found the wire mill 26 years ago.

✦ ✦ ✦

ARTHUR H. HANKS has been made superintendent of the cold drawn department of Allegheny Ludlum Steel Corporation's, Dunkirk, N. Y., plant. Mr. Hanks was assistant superintendent and succeeds the late E. H. Highley.

✦ ✦ ✦

Republic Steel Corp. Announces Personnel Changes

HOWARD B. CARPENTER, assistant vice president in charge of operations, Republic Steel Corp., Cleveland, has resigned and will open an office in Cleveland as consultant in steel mill operations. **E. M. Richards,** also assistant vice president in charge of operations for the company, will assume charge of the operations of Republic's steel districts, and **W. M. Kelley,** formerly works manager, Youngstown, O., plant of Truscon Steel Co., Republic subsidiary, has been transferred to Cleveland to take the position of assistant to the vice president in charge of operations and will have charge of Republic's manufacturing divisions.

THE 1945 CONVENTION OF THE WIRE ASSOCIATION WILL BE HELD AT CHICAGO, ILL. OCTOBER 15-19, 1945

SUPER-HARD
TALIDE
DRAWING DIES
WITH TUNGSTEN CARBIDE NIBS OF EXCEPTIONAL DENSITY, STRENGTH AND HARDNESS . . . INSURE
● BETTER FINISH ● GREATER ACCURACY
● LONGER LIFE ● FEWER REJECTS
on Drawing and Extruding WIRE, RODS, BOLTS, RIVETS and TUBING
TALIDE DIES are manufactured in all standard round hole sizes from R-1 to R-18
SPECIAL SHAPE DIES Oval, Square, Triangle, Hex etc., made to order
SHEET METAL DIES extra large for deep drawing, cartridge cases, liners, and cans, are also made with TALIDE NIBS
FULL PARTICULARS ON REQUEST
WRITE OR WIRE TODAY!
METAL CARBIDES CORPORATION
YOUNGSTOWN, OHIO

DIAMOND WIRE DRAWING DIES

Fort Wayne Wire Die Co., is housed in a new and up-to-date plant with every modern facility for producing dies under working conditions that make for quality. Although larger quarters were built last year, we have had to expand further to keep pace with the demands for more of these excellent dies.

The name "Fort Wayne" stands for the finest in quality and craftsmanship. Our customers can expect courteous and co-operative service on every order, and we strive to make each die so well that it will merit your good-will.

Range of Sizes: .0006" to .102"

You are invited to consult us on your diamond die problems. Please address inquiries to:

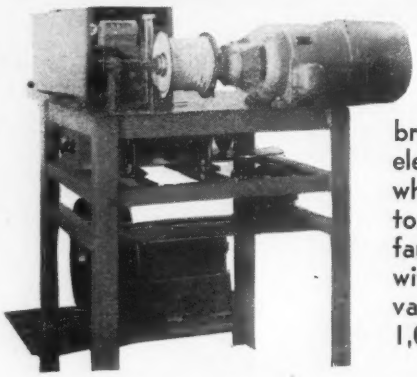
FORT WAYNE WIRE DIE COMPANY

2625 EAST PONTIAC STREET ● FORT WAYNE, INDIANA

Telephone: Harrison 4319

SPARKER for SPOOLING
SMALL WIRES

THIS APPARATUS WILL AUTOMATICALLY STOP WHEN DIELECTRIC FAULT OCCURS, or when the machine has wound a predetermined length of wire.



It is equipped with a gear head motor, electrical brakes on take-up and pay-off, electrode, control apparatus which automatically reduces the torque of the motor in starting, fault light indicator, transformer with tap switch, volt meter, and variac. Range of voltage from 1,000 to 16,000 volts.

Please Address Inquiries To:

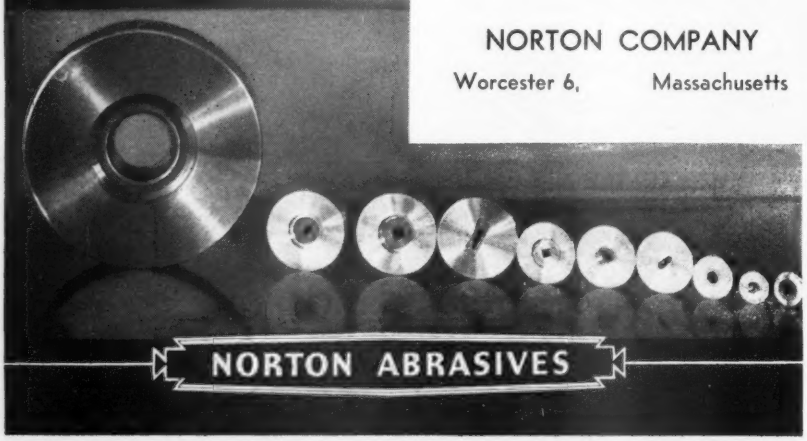
R. L. DAVIS ELECTRIC CO., INC.

WALLINGFORD, CONN.

NORBIDE Abrasive
For Wire Drawing Dies

NORBIDE Abrasive successfully replaces expensive diamond powder in efficiently shaping, grinding and polishing wire drawing dies—particularly those made of the hard cemented carbides. NORBIDE is the registered trade mark for Norton Boron Carbide (B_4C) — the hardest material made by man.

NORTON COMPANY
Worcester 6, Massachusetts



NORTON ABRASIVES

New Water Soluble Metal Cleaner

THE Phillips Chemical Company, 3411 West Touhy Ave., Chicago 45, Ill., announces **Swirt, an addition** to their line of **Controlled Cleaning** chemicals. **Swirt** is a powerful emulsifying cleaner that is entirely harmless to the worker and the work. It acts efficiently upon all types of materials: grease, buffing compounds, cutting and machining coolants and oils, and is equally effective upon ferrous and non-ferrous metals.

✦ ✦ ✦

AN added feature is that **Swirt** gives off no dangerous or disagreeable vapors to injure or annoy the operator. Being neither acid nor alkaline it will not etch or pit and can safely be used on the most sensitive metals and alloys. Fire hazards are reduced because of its high flash point, (155° open cup).

✦ ✦ ✦

ITS versatility suggests many uses. In automatic washing machines **Swirt** is effective in very weak dilutions; for equipment maintenance it may be used as a spray. It may be blown dry with air or hand wiped. Manufacturer offers a circular with more information.

✦ ✦ ✦

Sets Up Welding Shop and Laboratory

THE Eutectic Welding Alloys Company maintains a model welding shop and testing laboratory at its home office, 40 Worth Street in New York City. The welding shop has all the necessary equipment for electric arc, carbon arc, oxy-acetylene welding, gas flames and furnaces. The shop, under the supervision of Mr. H. V. Kough, a welding specialist, is used by the Eutectic Company to test random samplings of its welding rods and fluxes in order to assure its customers complete satisfaction.

✦ ✦ ✦

THE laboratory, besides containing the usual chemical reagents for the testing and etching of welds has facilities to determine the tensile strength of welded joints, the transverse tensile strength of all-weld metal as well as the hardness of welds and parent metals.

✦ ✦ ✦

WELDING rod users and their representatives are at liberty to weld and test Eutectic Welding Rod Alloys here.

Carbide Die Applications

(Continued from page 41)

sistance for relatively long bolts hardened steel bushings beneath the nib are used. These bushings have been found to satisfactorily resist the wear in the knock-out pin end.

✦ ✦ ✦

SUCCESSFUL operation depends upon careful observation of the above factors and the use of the proper grade of carbide which must be tough. We have found that the same grade of carbide may be used for most products whether heading or heading and extruding. Since this grade is tough and therefore appreciably softer than other grades which have given carbide the reputation of extreme hardness, it is necessary that the wire be properly coated in order to provide the necessary lubrication and prevent rapid wear and galling. If for any reason the coating is bad, the heading and extruding type of die in particular will pick-up on the extruding diameter with the result that the bolt will become scored and the die will eventually fail unless the die is immediately removed and cleaned. In certain types of machines, such as, boltmakers, good first station extrusion is a pre-requisite of successful second station operation where the bolt is both extruded again and headed. Most bolt plants today are using carbide exclusively in the first station so little trouble from improper first station operation is encountered. However, whenever first station dies gall as the result of using steel dies in cases of emergency or badly worn carbide dies, and as a result the coating is removed from the wire, faulty second station extrusion rapidly results through pick up due to improper lubrication. It is necessary then to remove both dies and re-polish them, otherwise heat checks resulting from high temperature stresses will rapidly result in chipping and break-down of the die. Sometimes this condition is directly traceable to the bundle of wire and to the wire supplier's failure to properly coat the wire. In the early stages of this war, the quality of wire for cold heading diminished and the troubles in heading increased in direct proportion. Today, however, the

(Please turn to page 82)

NILSON

AUTOMATIC PRESS and FOUR SLIDE MACHINE

FOR SWAGING, STAMPING, PIERCING, BLANKING, FORMING OF COILED METAL

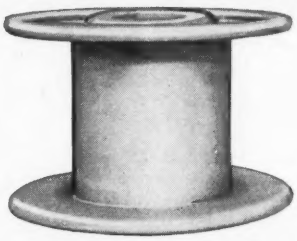
WE also build machines for forming Paper Clips, Buckles, Gate Hooks, Coat and Hat Hooks, Ceiling Hooks, Wire Ears, Cable Rings, Screw Eyes, Sash Chains, Automobile Side Chains, Flat Open Link Chains, Staples, Cotter Pins, Hose Clamps, Etc., and Wire Straighteners, Wire Reels, Frame Bending Machines and Special Presses.

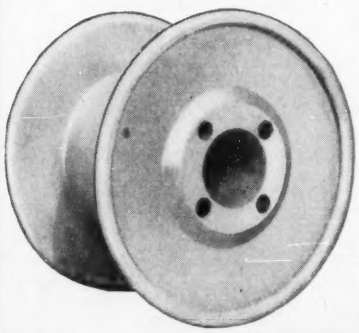
For Complete Details Address—

THE A. H. NILSON MACHINE CO.

BRIDGEPORT, CONN., U. S. A.

FOR HIGHEST SPEEDS





APCO MOSSBERG

PRECISION

STEEL REELS

The reels that are engineered to the job... designed and built by the company that originated the steel reel idea . . . are the reels you should be using in your plant. Every year, more and more Apco Mossberg Steel Reels are bought by quality-minded buyers throughout the wire industry.

FREE

ENGINEERING SERVICE

Without obligation to you, Apco Mossberg engineers will be glad to study your reel problem, and supply complete suggestions, drawings, blue prints. Write for information today.

REELS . . . SPOOLS . . . BOBBINS

APCO MOSSBERG COMPANY

(THE ORIGINAL FRANK MOSSBERG CO.)

21 LAMB ST., . . . ATTLEBORO, MASS.

Gilron

DRAW YOUR WIRE THE MODERN WAY with

GILRON COATING COMPOUNDS

A big step forward in wire drawing. Thoroughly proven in mill practice. Makes possible wire drawing speeds heretofore considered impracticable. Increases die life, prevents scratching of wire, produces better finish and eliminates use of lime in many cases.

These coating compounds are of particular value in the more difficult operations—stainless, alloy, high carbon and welding rod wire. Multiple reductions can be drawn without re-coating.

Coatings for Drawing Stainless, Alloy, Low and High Carbon and Copper Coated Wires

Let us confer with you. Write or telephone for particulars.

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1559 EAST 40th STREET • CLEVELAND, OHIO

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NEW — AND BETTER

PATENTING
TEMPERING
ANNEALING

The Trauwood PROCESS

OUTSTANDING ADVANTAGES

Higher and more uniform physical and fatigue properties.

No surface decarburization or scale. Faster wire speeds . . . greater production.

Equipment fully automatic and easy to operate.

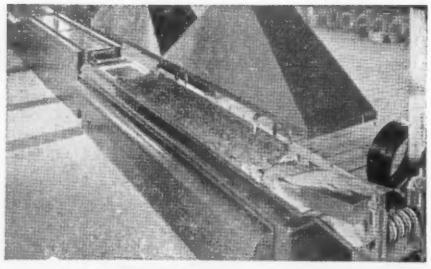
Control of heating and cooling cycles extremely accurate.

Thermal efficiency of the process very high.

Much finer grained structure possible.

High quenching temperatures rapidly attained.

Adaptable to high alloy and austenitic steel wire and strip (annealing of stainless).



Trauwood Electric Wire Tempering and Patenting Unit

The Trauwood Process, new in principle, eliminates high temperature furnaces and lead pots with their excessive maintenance costs and low thermal efficiencies. More positive temperature control is possible and quenching is done in a RISING temperature—instead of falling, as in conventional heat treating methods. The rapid rate of heating (4 to 5 times as fast as furnace heating) increases production and uniformly produces a finer grained product with higher physical and fatigue values.

Wire and rod patented by the Trauwood Process insures easier drafting and makes heavier reductions possible. In conjunction with the Trauwood patenting equipment, pickling, coating and baking can be made continuous, eliminating expensive handling and delay, materially reducing costs as compared with ordinary methods.

Complete details of the Trauwood Process will be furnished you on request. Our engineers will help you solve your continuous wire and strip patenting, tempering, and annealing problems. Write today.

THE TRAUWOOD ENGINEERING COMPANY

1740 E. 23rd STREET, CLEVELAND, OHIO, U.S.A.

Carbide Die Applications

(Continued from page 81)

wire is appreciably better so difficulties from this source are now rarely experienced.

✦ ✦ ✦

APPRECIABLE wear in the hole in the die in the portion below the carbide nib for long bolts can be kept to a minimum by using knock-out pins that are the maximum diameter permitted by the extrusion diameter in the die or by the hole size in a plain heading die. Under size knock-out pins permit the metal from the bolt to squeeze between the knock-out pin and the hole in the die and rapid wear develops.

✦ ✦ ✦

APPRECIATION of the above factors makes it apparent that the carbide die manufacturer must be not only a die maker but also must be conversant with conditions under which the dies are used, for mis-use and condemnation of carbide dies thereby may result in retarding general acceptance of carbide dies for cold heading. Certain applications are definitely undesirable and we have found on numerous occasions that when everything else has failed users are inclined to feel that the carbide die might solve their problem. This attitude naturally requires the careful consideration of the carbide die manufacturer who through a policy of education must familiarize the user with what applications are desirable and undesirable.

✦ ✦ ✦

CARBIDE heading dies find most economical operation on long production runs where the higher die price distributed over large quantities of the product shows a marked reduction in die cost per unit produced. In those cases where close tolerances must be maintained at the expense of appreciable loss of production on steel dies, carbide dies again provide economies through minimum down-time, reduced inspection costs, and low scrap loss.

✦ ✦ ✦

COINCIDENTAL with the use of carbide heading dies in the header, other tooling has been developed for carbide. One of the most successful is that of cut-off knives and quills with carbide inserts which not only provide long production runs but also excellent cut-off. Of course, in

the Boltmaker the first station is a proven application for carbide as stated above. Coning and finishing punches have recently been fitted with carbide inserts and despite the limited casing diameter and undesirable clearances required, these parts have given excellent performance particularly in the field of heading aluminum where the heading pressures are not heavy enough to reflect any structural weaknesses. Firthaloy punches for round head machine screws have been in use for a number of years. At one plant where careful production records are kept of each Firthaloy die, the phenomonal production of 49,500,000 pieces was obtained on a Firthaloy punch for a 10-32 oval-head machine screw. This punch was in continual operation for about three years and was not damaged at the time of the above production when it was removed in order to be examined to determine what factors both in materials and construction contributed to this long life.

✦ ✦ ✦

IN conclusion, the carbide cold-heading die for a large portion of commonly headed products is definitely out of the experimental stage wherein improvements in materials, workmanship and design, stimulated by the occasional outstanding production runs of that period, made today's reliability commonplace.

✦ ✦ ✦

BY judicial application, carbide cold-heading dies shall find exclusive use on a great variety of products particularly after the war when competitive costs will force the economies of carbide for cold-heading.

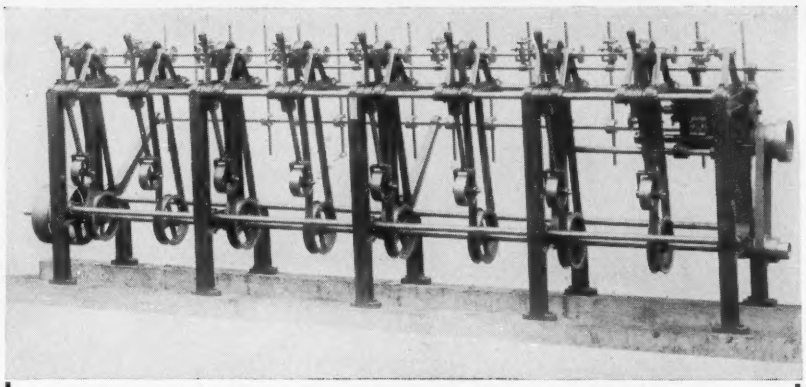
THE WIRE ASSOCIATION

WHAT IT GIVES YOU FOR $10.00 ANNUAL DUES

1. Wire & Wire Products—for one year
2. The Annual Buyers Guide & Year Book of The Wire Association
3. Questions and Answer Service
4. Annual Convention and Exhibition
5. Regional Meetings
6. Personal Contacts
7. Information Service on Machinery, Equipment and Supplies

FOR DETAILED INFORMATION ADDRESS

RICHARD E. BROWN,
Executive Secretary
300 MAIN ST., STAMFORD, CONN.



No. 1900E SPOOLER

WIRE SPOOLING MACHINES

Model illustrated takes spools up to 12" diameter. Floor space required: 19" x 10'; length can be varied to suit largest spool specified. Handles wire up to .050" diameter. Other models made to suit specific requirements.

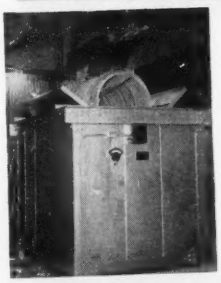
EMORY SPOOLERS are built for years of continuous service. Precision made, durable, rugged, dependable.

BUILDERS OF WIRE SPOOLING MACHINERY for A HALF CENTURY

For details, write to

ROBERT J. EMORY COMPANY
31 East Runyon Street
NEWARK 5, N. J.
Telephone Bigelow 3-4415

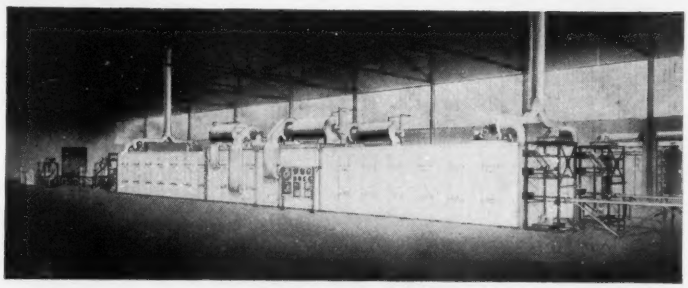
MORE PRODUCTION IN LESS TIME *with*



CARL-MAYER HI-SPEED
ROD BAKER

The fastest rod baker built! Saves up to 50% in time and fuel. Patented Blow-Off Feature removes moisture without bumping or agitating the coils. **Patented and patents pending.**

CARL-MAYER FURNACES, OVENS



WELDING ROD OVEN

For drying coated welding rods. Uses the "Mayer" Recirculating Gas Fired Air Heater principle and Rod Transfer Systems (patents pending).

Growing interest in our type of equipment is evidenced by Carl-Mayer installations in such plants as:—

Atlantic Wire Co.
Atlas Tack Corp.
Atlas Steel Co.
Eaton Mfg. Co.
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Page Steel & Wire Co.
WRITE for BULLETIN No. 241
Pittsburgh Tool Steel Wire Co.
Steel Co. of Canada
Wickwire Spencer Steel Co.

THE CARL-MAYER CORPORATION
3030 EUCLID AVENUE
CLEVELAND, OHIO

A NEW ADDRESS
for
RUSCH WIRE DIE CORP.

✦ ✦ ✦

After January 1, 1945
our offices and factory will be located in
Croton-on-Hudson, N. Y.

Increased facilities and improved equipment developed by us through scientific research will offer our customers our approved quality Diamond and Tungsten Carbide Dies and Tools produced by the most modern methods of manufacture.

We take this opportunity to express our appreciation to our friends and customers for their confidence in our products which has made this progress possible.

Revised Symbols for Communications Equipment

A revised American Standard for Graphical Symbols for Telephone, Telegraph, and Radio Use has just been approved by the American Standards Association, giving new symbols for new types of apparatus and reconciling conflicts in previous standards. The spur that war needs have given to the development of radio and communications equipment places upon the standard a particular importance for engineers, designers, and draftsmen in the power and communications fields.

✦ ✦ ✦

WORK on the standard has been carried out under the technical leadership of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers, with the Signal Corps Standards Agency, the Aeronautical Board and the Bureau of Ships cooperating as well as the industries concerned. It is understood that the new standard is already being placed in use by the Signal Corps and will be used by the Ground Signal Publications Agency in the preparation of all future drawings and instruction books for Signal Corps ground signal equipment.

✦ ✦ ✦

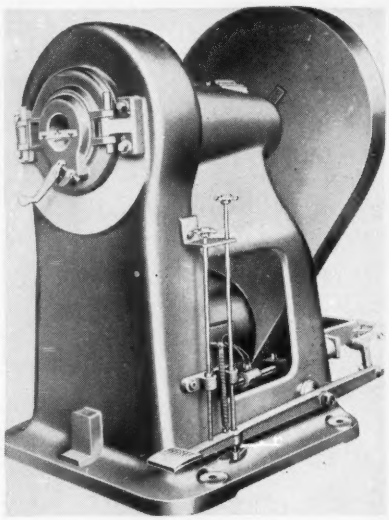
THIS standard forms another completed part of a comprehensive series of standards covering abbreviations and symbols for various engineering and scientific fields, which is being carried out by industrial, engineering, and governmental groups through the American Standards Association. It is a revision of and supersedes the American Standards Symbols for Telephone, Telegraph, and Radio Use (Z32.5) published in 1942; but it includes solutions for conflicting symbols in the power and communications fields that were worked out in the war standard published earlier this year (232.11) and it incorporated new material.

✦ ✦ ✦

THE American Standard Graphical Symbols for Telephone, Telegraph and Radio Use (Z32.5-1944) may be obtained from the American Standards Association, 70 East 45th St., New York 17, at 30c per copy.

Rate of Production Increased Fifteen Times by New Automatic Die Opening Cable Swager

THE Cable Swager produced by the **Standard Machinery Company** of Providence, R. I., has been redesigned into a fast automatic die opening and automatic feeding unit requiring only three seconds for each complete operation.



New automatic die opening cable swager showing centering guide, die control lever on door, and foot pedal that sets work feed into action.

THIS new machine has increased the production rates obtained in the attachment of fittings to cable as much as fifteen times, through the use of its quick acting die opening device and its automatic feed. The cable swager delivers a positive relation between cable and fitting in the processing, makes it a one man operation, and eliminates the necessity for removing the dies for each cable swaging operation using large end fittings.

✦ ✦ ✦

THIS cable swager utilizes the rotary swaging action for working the shank metal of the fitting around the cable strands but the operation is simplified by its hand control for opening and closing the dies from the front of the machine while it is running at the normal flywheel speed. The clearance when the dies are opened is sufficient to accomodate all standard types of fitting attachments.

✦ ✦ ✦

THE cycle of operation consists of passing the fitting that is loosely

NEW Oakite CrysCoat Process

(Trade Mark Reg. U. S. Pat. Off.)

for Wire Drawing!

Two outstanding advantages result when you apply the Oakite CrysCoat Process to ferrous rods and wire in your cleaning house, viz.:

1. Increased Production
2. Longer Die Life

This newly-developed Oakite CrysCoat Process imparts a fine-grained crystalline phosphate coating to surfaces of ferrous rods and wire which serves as an added lubricant and enables you to get MORE production and tonnage before changing dies. Inquiries on this NEW development invited from wire mill superintendents to whom details will be gladly sent!

OAKITE PRODUCTS, INC.
52A THAMES ST., NEW YORK 6, N. Y.

Technical Service Representatives Located In All Principal Cities of the United States and Canada

OAKITE — Buy Bonds for Victory
MATERIALS...METHODS...SERVICE

STEEL WIRE

By MAURICE BONZEL

✦ ✦ ✦

Translated and Published by

Kenneth B. Lewis

Consulting Engineer

✦ ✦ ✦

Price $15.00

✦ ✦ ✦

495 pages—414 illustrations

✦ ✦ ✦

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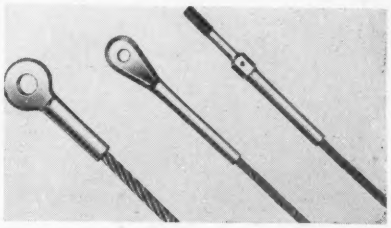
hung over the end of the cable through the open dies into the adjustable feed socket. The cable end is held firmly against the bottom of the fitting and ready for swinging the handle on the door front to a vertical position to start the swaging action. The foot treadle is released and the work is moved automatically through the dies to the completion point as set for the particular length of shank fitting used. The work moves from back to front in this swaging action. The dies are opened by making a quarter turn upon this same lever and the attached fitting is removed to complete the cycle.



Examples of shank type fittings as swaged on cable by cable swager. ✦ ✦ ✦

FITTINGS after attachment have a smooth surface on the circumference of the shank and are swaged so firmly on the cable that the fitting and cable strands appear to be fused. The strength of the connection exceeds the tensile limitations of the cable itself.

✦ ✦ ✦

FOUR sizes of **Standard** Cable Swaging Machines are offered to handle cable sizes from 1/16″ to 1½″.

✦ ✦ ✦

Opens Chicago Sales Office

THE Beryllium Corporation of Pennsylvania, Reading, Pa., announces the reopening of their Chicago Sales Office, at 205 West Wacker Drive, Chicago, Illinois. The District Manager will be Thomas E. Neal, graduate engineer, whose previous experience in the electrical industry and familiarity with beryllium alloys will enable him to be of assistance to users of beryllium products.

✦ ✦ ✦

WHILE the company is a producer of basic beryllium-copper from ore, their major products have always been strip, rod, wire, castings and safety tools. At present they manufacture and sell only beryllium alloys.

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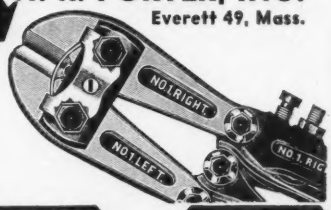

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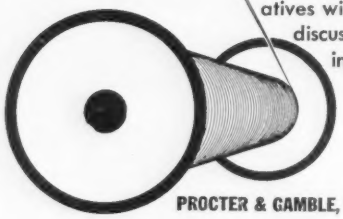

PROCTER & GAMBLE, CINCINNATI, O.

Wire in Combat

WITHIN a period of four months the 143rd Armored Signal Company, now with the First U. S. Army in France, laid more than 7,000,000 feet of wire. While members of the Company believe this is a record, they are prouder of the repair job they have done in the sectors assigned to them.

✦ ✦ ✦

LAYING wire, Signal Corps officers point out, is only the beginning of the signalmen's job. Keeping it in repair is a still bigger job, for the tank that is usually a friend of the wire-laying team is also a wrecker of wire, while enemy artillery and windstorms lend a hand toward knocking out still more of it.

✦ ✦ ✦

REPAIRING wires is often more hazardous than laying them. Early in August, 1944, when the Germans were trying to drive through to the sea and split the American forces, the little town of Juvigny, near Mortain, was a key in the defense against enemy counter-attacks. The Germans controlled the surrounding hills to the north and artillery fire was so thorough that the American forces were pinned to their fox holes. Three times during the day of August 4, the wire team composed of Cpl. James D. Matthews, Cleveland, Ohio, and Pvt. Ivan N. Kaufman, Adel, Iowa, got up out of their fox holes to brave the fire and repair the lines.

✦ ✦ ✦

AT 9 p.m., with darkness falling, the lines went out again, and once more Matthews and Kaufman were called for. The big guns and the mortars were still pouring in shells as these two men followed the wire into town, looking for the break. Down the narrow streets they went. Suddenly, at the whine of a dropping round, the wiremen plunged to the ground. But only Kaufman got up. Matthews had been hit by shrapnel.

✦ ✦ ✦

WITH the shells dropping all around Kaufman picked up his buddy and placed him in a jeep. Nearby an injured infantryman cried for help and Kaufman also dragged him to the jeep and got him inside. Just then another shell landed and this time fragments caught Kaufman. Still on his feet, however, the lineman got into the vehicle and drove the two injured men to the field hospital, where all three were given emergency treatment.

✦ ✦ ✦

Gun for Sealing and Insulating

WIRE mill executives will be interested in a new gun designed to speed up the sealing and insulating of refractory walls.

✦ ✦ ✦

THIS Gun syphons dry **Therm-o-Flake** Insulation direct from the shipping carton, mixes with water and sprays to the refractory wall in one operation. Premixing is eliminated. Application is 6 to 8 times faster than by manual methods.

✦ ✦ ✦

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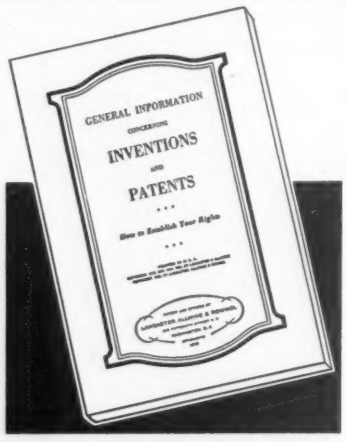
✦ ✦ ✦

LITERATURE and complete details are available by writing the Illinois Clay Products Company, 608 South Dearborn Street, Chicago 5, Illinois.



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Silver Brazing Chemical Mortar Shells

IN an article entitled "Low Temperature Silver Brazing Used in Making Chemical Mortar Shell", Col. H. R. Lebkicher of the Chemical Warfare Service discusses the conditions and proper treatment for brazing with silver alloys, with special reference to the 4.2 chemical mortar shell now being used by our armed forces. This shell consists primarily of a body with a base at one end, an adapter at the other, both brazed to the body with Easy-Flo silver brazing alloy.

✦ ✦ ✦

CHEMICAL cleaning and fluxing, and the properties and working temperatures of silver brazing alloys are discussed in detail, as well as operating methods involved in brazing. A complete and well-outlined cycle of operations is shown, beginning with the cleaning of the shell to testing for leaks in the final product. The advantages of low temperature silver brazing for war usages are pointed out.

✦ ✦ ✦

COPIES of this article may be obtained from Handy & Harman, 82 Fulton Street, New York 7, New York.

✦ ✦ ✦

New Heating Bulletins

SURFACE Combustion, Toledo 1, Ohio, has published two new bulletins that may be of interest to some of our readers. These are: SC-122, "Convection Heating in SC Furnaces", and SC-123, "Tool Room Flexibility with Standard Rates SC Furnaces".

✦ ✦ ✦

THE first illustrates and describes six types of convection furnaces for bar, rod, tube, etc., annealing, and the second covers a line of convection, muffle, pot and oven furnaces especially designed to bring out the best qualities in cutters, drills, taps, punches, jigs, dies and other tools made of expensive and sensitive alloy steels. These bulletins are available on request.

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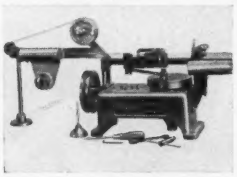

Bench Type Butt Welder

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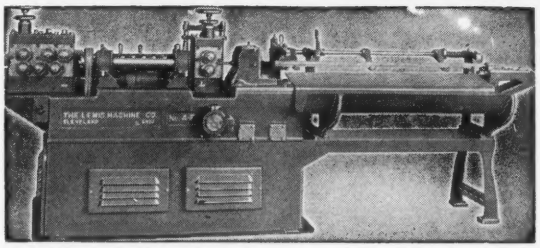

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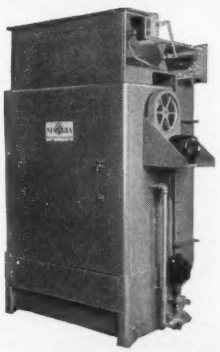

U. S. Patent Nos. 2,296,946 and 2,321,933

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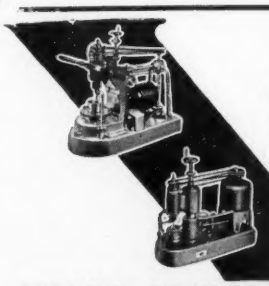

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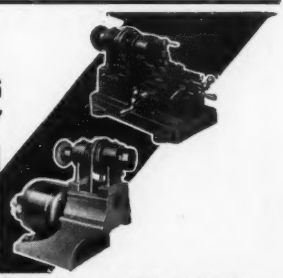

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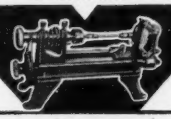

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New Book by Grodzinski

"DIAMOND TOOLS" is the title of a new book from the pen of Paul Grodzinski, Technical Consultant for the Industrial Diamond Review, London, England.

✦ ✦ ✦

THE book is published by Anton Smit & Co., Inc., 333 West 52nd Street, New York 19, N. Y. and will sell for $4.50 a copy. It covers 379 pages of text and is bound in stiff cloth covers.

✦ ✦ ✦

BEGINNING with a chapter on the production and qualities of diamonds, it goes on to describe the diamond from a technical standpoint, and then takes up in a series of chapters, the various applications of diamonds to various types of tools of industry—as bearings, for hardness testing, for grinding and cutting, drilling, engraving and, of course, the use of the diamond in drawing fine wire.

✦ ✦ ✦

THE text is amply illustrated and supported with appropriate charts and tables, and complete reference bibliographies are appended to each chapter, and for concerns either using or manufacturing diamond tools, should prove a practical addition to the library.

✦ ✦ ✦

Interesting New Application of Carbide in Grinding

USE of carbide gage fingers has insured accurate gaging during grinding at a large aircraft engine plant in Detroit, under conditions which would wear steel fingers away so rapidly that the operator would be forced to continually re-set his gage.

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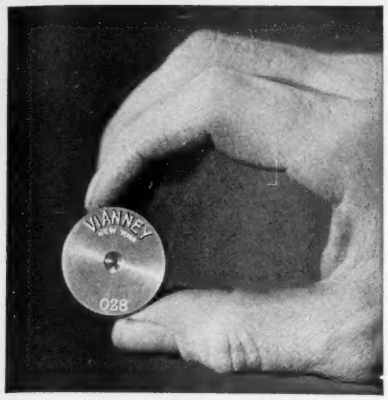

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The use of diamonds and gem stones as dies for fine wire drawing, and of diamonds for cutting tools, is comparatively recent. Today it is extensive and increasing. In this book the author has brought together all the data and information available on the subject and has added the results of his own experience and research. Although dealing mainly with the actual production of the dies and tools, the knowledge this book imparts is of prime importance to tool users. Efficiency and economy in the use of diamond and gem stone dies and tools is not possible without a knowledge of production methods.

There are reference tables and a large number of specially drawn illustrations included in this book. An endeavor has been made to leave no phase of the subject untouched.

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✦ ✦ ✦

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IT is designed for the use of all those who want to know about the properties, applications, peculiarities of metals, alloys and raw materials used in metallurgy. It will serve as a short cut to a wealth of information on numerous commercial metals and alloys.

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✦ ✦ ✦

PUBLISHED at $4.50 by Chemical Publishing Co., Inc., 26 Court St., Brooklyn 2, N. Y.

✦ ✦ ✦

WOPIS At New Address

WOPIS INDUSTRY LABORATORY has moved to new and larger quarters at 1781 East 15th Street, Brooklyn, 15, N. Y., where they now have their own building. Besides supplying dies and tools in carbide, stainless, chromium and other metals, the organization is now making diamond dies and wheels, diamond powders and die castings. The company is equipped to do finishing, drilling, etc., to .0001" tolerances.

✦ ✦ ✦

Folder Gives Latest Diamond Tools

THE Champion Diamond Company, 551 Fifth Avenue, New York, 17, N. Y., has published a new circular describing and illustrating their complete line of diamond tools, wheels, wire drawing dies, sawblades, core bits and other items. Copies may be had by writing the Company.

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New Book Tells How To Get Top Performance with Carbide Mandrels

OF special interest to tube mill men will be the new 20-page booklet entitled "Tips for Tube Mills on the Use of Carboloy Mandrels" which has just been issued by Carboloy Company, Inc., Detroit 32, Michigan.

✦ ✦ ✦

CARBIDE mandrels used in modern tube draw-benches should be given the same care as any other precision tool used in mass production. With these precautions, it is stated, use of carbide mandrels will insure better inside finish, closer tolerances on long runs, more continuous operation, and fewer rejections.

✦ ✦ ✦

CAREFUL cleaning and pickling, the book states, is essential to avoid scratches on tubing. A light etch on the tubing holds the lubricant better and provides a good uniform drawing surface. It is important that all tubes remain lubricated throughout the drawing operation. The mandrel will pick up and scratch the tubing if tubes are improperly lubricated. All tubes should be annealed after each pass to obtain greater economies and longer mandrel life. All mandrels should be serviced at regular, predetermined intervals rather than when they "appear" to need servicing.

✦ ✦ ✦

THE booklet is illustrated with numerous blue-print type sketches.

✦ ✦ ✦

Fidelity Machine Company Fourth Time Army-Navy Production Award

H. W. ANDERSON, President and General Manager of the Fidelity Machine Company, has just advised the Men and Women of the Fidelity Machine Company that they have won for the fourth time the Army-Navy Production Award for outstanding achievement in producing materials essential to the war effort.

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2—Waterbury Step Cone Wire Drawing Machines
1—Waterbury Bull Block Motor Driven
1—Lewis Welding Wire S. & C. Machines M.D.
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Bulletin Describes Line of Tachometers

BULLETIN No. 44-1, just published by Jones Motrola Company, Fairfield Avenue, Stamford, Connecticut, manufacturers of tachometers and other industrial products, describes four models of Jones individual-mount tachometers and the Jones multi-range portable hand tachometer.

✦ ✦ ✦

THE bulletin shows both full-face and profile views of the individual tachometers, r.p.m. ranges available, mounting dimensions, and includes prices for tachometers and appurtenances, a section on use and operation, and general installation data.

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For more complete information, consult the annual Wire and Wire Products Directory, Index & Buyers' Guide.

ABRASIVES—
Norton Co., Worcester, Mass.

ACID INHIBITORS—
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

ACID-PROOF CONSTRUCTION—
Ceilcote Co., The, Cleveland, Ohio
Haveg Corp., Newark, Del.
Heil Engineering Co., Cleveland, Ohio
Nukem Products Co., Buffalo, S. Y.

AIR DRAW FURNACES—
Carl-Mayer Corp., The, Cleveland, Ohio.

ALKALINE CLEANERS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.

ANNEALING MACHINES—
Open Flame
Syncro Machine Co., Perth Amboy, N. J.

ANNEALING POTS AND BOXES—
National Annealing Box Co., Washington, Penna.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.

ARMORING EQUIPMENT—
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

BAKERS—Rod and Wire
Carl-Mayer Corp., The, Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
Moslo Machinery Co., Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N. Y.

BELTS—Wire
Wickwire Spencer Steel Co., Sew York, N. Y.

BENDERS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

BOBBINS—Braider & Wire Weaving
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

BORON CARBIDE—
Norton Co., Worcester, Mass.

BRAKES & SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

BRICKS—Acid Proof
Keagler Brick Co., Steubenville, Ohio.
Nukem Products Co., Buffalo, N. Y.

CABLE LACQUERING OVENS
Industrial Oven Engr. Co., Cleveland, Ohio.

CABLE REEL BORERS—
Root, B. M., Co., York, Pa.

CABLE—Steel and Copper
Brewer Mfg. Co., Muncy, Pa.

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.

CASTINGS—Wire Mill
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.

CEMENTS—Acid Proof
Sauereisen Cement Co., Pittsburgh, Pa.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CHEMICALS—Cleaning
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANERS—Hand and Metal
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANING & PICKLING EQUIP.
Broden Construction Co., Cleveland, O.
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Haveg Corporation, Newark, Del.
Heil Engineering Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Nukem Products Corp., Buffalo, N. Y.
Vaughn Machinery Co., Cuyahiga Folls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

CLOTH TESTERS—
Scott, Henry L., Co., Providence, R. I.

CLOTH—WIRE, All Metals
Roebling's, John A. Sons, Co., Trenton, N. J.
Wickwire Spencer Steel Co., New York, N. Y.

COATING COMPOUNDS—
Apex Alkali Products Co., Philadelphia, Pa.
Gilron Products Co., Cleveland, Ohio.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

COILERS—Sheet, Strip and Wire
Broden Construction Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

COLD HEADERS—
Ajax Manufacturing Co., Cleveland, Ohio.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

COMPOUNDS—Coppering
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Metal Finishing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Gilron Products Co., Cleveland, Ohio.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Potter, Neil C., Newark, N. J.
Procter & Gamble, Cincinnati, Ohio.
Shell Oil Co., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

CONTROLS—Heat Treating
Niagara Blower Co., Buffalo, N. Y.

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Carboloy Co., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Vascoloy-Ramet Corp., North Chicago, Ill.

CUTTING TOOLS—Wire
Porter, H. K., Inc., Everett, Mass.

DIAMONDS—Industrial
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vianney Wire Die Wks., New York, N. Y.

DIAMOND POWDERS—
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Wopis Industry Laboratory, Brooklyn, N. Y.

DIAMOND TOOLS—
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.

DIES—Diamond
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Cochaud Wire Die Corp., New York, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Luginbill Wire Die Co., Fort Wayne, Ind.
Master Wire Die Corp., Glendale, N. Y.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
United Die Co., Newark, N. J.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Wopis Industry Laboratory, Brooklyn, N. Y.

DIES—Lead Extrusion
Robertson, John, Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies Co., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carbide Die Works, Inc., Hartford, Conn.
Carboloy Co., Inc., Detroit, Mich.
Cochaud Wire Die Corp., New York, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Hartley Wire Die, Thomaston, Conn.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Luginbill Wire Die Co., Fort Wayne, Ind.
Metal Carbides, Inc., Youngstown, Ohio.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Rod and Tube Drawing
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carbide Die Works, Hartford, Conn.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Hartley Wire Die, Thomaston, Conn.
Kelly Wire Die Corp., New York, N. Y.
Master Wire Die Corp., Glendale, N. Y.
Metal Carbides, Inc., Youngstown, Ohio.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Tungsten Electric Corp., Union City, N. J.
United Die Co., Newark, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tantalum Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carbide Die Works, Hartford, Conn.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Hartley Wire Die, Thomaston, Conn.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides, Inc., Youngstown, Ohio.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tungsten Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carbide Die Works, Inc., Hartford, Conn.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Hartley Wire Die, Thomaston, Conn.
Kelly Wire Die Corp., New York, N. Y.
Master Wire Die Corp., Glendale, N. Y.
Metal Carbides, Inc., Youngstown, Ohio.
Michigan Wire Die Works, Detroit, Mich.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Tungsten Electric Corp., Union City, N. J.
United Die Co., Newark, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.
Wopis Industry Laboratory, Brooklyn, N. Y.

DRAW BENCHES—
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.
Standard Machinery Co., Providence, R. I.
Vaughn Machinery Co., Cuyahoga Falls, O.

DRUMS—Flange Steel
Hubbard Spool Co., Chicago, Ill.
Stevens Metal Products Co., Niles, Ohio.

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

DRYING & PRE-HEATING ROOMS
Carl-Mayer Corp., Cleveland, Ohio.
Industrial Oven Engr. Co., Cleveland, Ohio.

DRYING EQUIPMENT
Carl-Mayer Corp., Cleveland, Ohio.
Ross, J. O., Engr. Corp., New York, N. Y.

ELECTRIC RESISTANCE HEATING
Trauwood Engr. Company, Cleveland, Ohio.

ENGINEERS—Consulting Wire Mill
Hartley, George D., Worcester, Mass.
Lewis, Kenneth B., Worcester, Mass.

EQUIPMENT—Humidifying
Niagara Blower Co., Buffalo, N. Y.

EQUIPMENT—Insulation Testing
Davis, R. L., Electric Co., Wallingford, Conn.
Entwistle, James L., Co., Pawtucket, R. I.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FENCES AND FENCING—Wire
Wickwire Spencer Steel Co., New York, N.Y.

FLUXES—Soldering
American Chemical Paint Co., Ambler, Pa.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin, Wm. M., Co., Pittsburgh, Pa.

WHERE TO BUY, Continued

FRICTION PAY-OFF STANDS—
Industrial Oven Engr. Co., Cleveland, Ohio.

FURNACES—Annealing
Ajax Manufacturing Co., Cleveland, Ohio.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Holden, A. F., Co., The, New Haven, Conn.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Trauwood Engr. Company, Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Automatic
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio.
Firth-Sterling Steel Co., McKeesport, Pa.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, Ohio.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Electric
Ajax Manufacturing Co., Cleveland, Ohio.
Eisler Engineering Co., Newark 3, N. J.
Electric Furnace Co., Salem, Ohio.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Trauwood Engr. Company, Cleveland, Ohio.

FURNACES—Hard'ing & Temp'ing
Ajax Manufacturing Co., Cleveland, Ohio.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Holden, A. F., Co., The, New Haven, Conn.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Trauwood Engr. Company, Cleveland, Ohio.

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Robertson, John, Co., Brooklyn, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

FURNACES—Non-Oxidizing
Ajax Manufacturing Co., Cleveland, Ohio.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Holden, A. F., Co., The, New Haven, Conn.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

FURNACES—Normalizing
Ajax Manufacturing Co., Cleveland, Ohio.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Holden, A. F., Co., The, New Haven, Conn.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

FURNACES—Pot (Oil, Gas and Electric)
Ajax Manufacturing Co., Cleveland, Ohio.
Holden, A. F., Co., The, New Haven, Conn.

FURNACES—Salt Bath
Ajax Manufacturing Co., Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Holden, A. F., Co., The, New Haven, Conn.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

FURNACES—Wire, Strip & Sheet
Carl-Mayer Corp., The, Cleveland, Ohio.
Eisler Engineering Co., Newark 3, N. J.
Electric Furnace Co., Salem, Ohio.
Holden, A. F., Co., The, New Haven, Conn.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

GALVANIZING EQUIPMENT—
Meaker Co., The, Chicago, Ill.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

GALVANIZING KETTLES
National Annealing Box Co., Washington, Penna.

GRINDERS—Roll
Norton Co., Worcester, Mass.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

INSULATING LACQUERING SYSTEMS—Continuous
Industrial Oven Engr. Co., Cleveland, Ohio.

KETTLES—Galvanizing, Annealing, Tinning, etc.
National Annealing Box Co., Washington, Penna.

LATHES—Die Reaming
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Morgan Construction Co., Worcester, Mass.
Roos, H. & G., Tool & Mfg. Co., Montclair, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry & Machine Co., Waterbury, Conn.

LININGS—Acid and Alkali Proof
Ceilcote Co., The, Cleveland, Ohio.
Haveg Corp., Newark, Del.
Heil Engineering Co., Cleveland, Ohio.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Shell Oil Co., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

LUBRICANTS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Potter, Neil C., Newark, N. J.
Shell Oil Co., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Robertson, John, Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
Fidelity Machine Co., Philadelphia, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Brazing
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Bunching
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable Reel Boring
Root, B. M., Co., York, Pa.

MACHINERY—Chain Making
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY— Coilers
Broden Construction Co., Cleveland, Ohio.
Eisler Engineering Co., Newark 3, N. J. (for Tungsten Wire)
Morgan Construction Co., Worcester, Mass.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cold Heading with Wire Drawing Attachment
Ajax Manufacturing Co., Cleveland, Ohio.

MACHINERY—Copper Wire Drawing and Rolling
American Insulating Mach'y Co., Phila., Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Cutting
Ajax Manufacturing Co., Cleveland, Ohio.
Broden Construction Co., Cleveland, Ohio.
Eisler Engineering Co., Newark 3, N. J.
Lewis Machine Co., The, Cleveland, Ohio.
Moslo Machinery Inc., Cleveland, Ohio.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Porter, H. K., Inc., Everett, Mass.
Shuster, F. B., Mfg. Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Die Making
Firth-Sterling Steel Co., McKeesport, Pa.
Roos, H. & G., Tool & Mfg. Co., Montclair, N. J.

MACHINERY—Draw Benches
Ajax Manufacturing Co., Cleveland, Ohio.
Broden Construction Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Edging
Broden Construction Co., Cleveland, Ohio.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Industrial Oven Engineering Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Extruding
Robertson, John, Co., Brooklyn, N. Y.
Royle, John, & Sons, Paterson, N. J.

MACHINERY—Filament Coil Winding
Eisler Engineering Co., Newark 3, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, Ohio.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY— Forming
Eisler Engineering Co., Newark 3, N. J.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Galvanizing
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, Ohio.
Meaker Co., The, Chicago, Ill.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Gang Winders
Fidelity Machine Co., Philadelphia, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., Worcester, Mass.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Knitting
Fidelity Machine Co., Philadelphia, Pa.

WHERE TO BUY, Continued

MACHINERY—Lead Encasing Presses, etc.
Robertson, John, Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
Robertson, John, Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Material Handling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

MACHINERY—Measuring Wire & Cable
Durant Mfg. Co., Milwaukee, Wis.
Lyon-Vail Machine Co., Brockton, Mass.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Nail and Tack
Broden Construction Co., Cleveland, Ohio.
Glader, Wm., Machine Works, Chicago, Ill.
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co. Perth Amboy, N. J.

MACHINERY—Pointing
Broden Construction Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Quill Winding
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Rubber for Insulating Wire
Royle, John, & Sons, Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio.
Emory, Robert J., Co., Newark, N. J.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I. (Special Designs)
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
American Insulating Mach'y Co., Phila., Pa.
Eisler Engineering Co., Newark 3, N. J.
Emory, Robert J., Co., Newark, N. J.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Ajax Manufacturing Co., Cleveland, Ohio.
Broden Construction Co., Cleveland, Ohio.
Lewis Machine Co., The, Cleveland, Ohio.
Moslo Machinery Co., Cleveland, Ohio.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Shuster, F. B., Mfg. Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Stranding
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Construction Co., Cleveland, Ohio.
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Swaging
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Testing
Scott, Henry L., Co., Providence, R. I.

MACHINERY—Testing Equipment—Sparkers
Entwistle, Jas. L., Pawtucket, R. I.

MACHINERY—Testing Spring
Standard Machinery Co., Providence, R. I.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co, Torrington, Conn.

MACHINERY—Welding Wire
Eisler Engineering Co., Newark 3, N. J.
Micro Products Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Eisler Engineering Co., Newark 3, N. J.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wind-up (Constant Tension, Variable Speed)
Industrial Oven Engr. Co., Cleveland, Ohio.

MACHINERY—Wire Bending
Eisler Engineering Co., Newark 3, N. J.
Nilson, A. H., Co., Bridgeport, Conn.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Wire Drawing
Ajax Manufacturing Co., Cleveland, Ohio.
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio.
Eisler Engineering Co., Newark 3, N. J.
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Wire Measuring
Durant Mfg. Co., Milwaukee, Wis.
Lyon-Vail Machine Co., Inc., Brockton, Mass.
New England Butt Co., Providence, R. I.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Tinning
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Wood Screw
National Machinery Exchange (Used), New York, N. Y.

MATERIAL HANDLING EQUIP.
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem Rolling and Edging
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co, Torrington, Conn.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Hudson Wire Co., Ossining, N. Y.

OILS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Shell Oil Co., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

OVENS—Cable Lacquering
Industrial Oven Engr. Co., Cleveland, Ohio.

OVENS—Dehydrogenizing
Carl-Mayer Corp., Cleveland, Ohio.
Industrial Oven Engr. Co., Cleveland, Ohio.

OVENS—Industrial
Carl-Mayer Corp., Cleveland, Ohio.
Industrial Oven Engr. Co., Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N. Y.

OVENS—Welding Rod Coating
Carl-Mayer Corp., Cleveland, Ohio.
Industrial Oven Engr. Co., Cleveland, Ohio.
Moslo Machinery Co., Cleveland, Ohio.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PAINTS—Marine
American Chemical Paint Co., Ambler, Pa.

PAINTS—Structural Steel
American Chemical Paint Co., Ambler, Pa.

PANS—Lead and Spelter
National Annealing Box Co., Washington, Penna.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Crepe-Kraft Co., Newark, N. J.

PAPER TESTERS—
Scott, Henry L., Co., Providence, R. I.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D. C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

PICKLING TANK LININGS—
Ceilcote Co., The, Cleveland, Ohio.
Haveg Corp., Newark, Del.
Heil Engineering Co., Cleveland, Ohio.
Keagler Brick Co., Steubenville, Ohio.
Sauereisen Cement Co., Pittsburgh, Pa.

PIPES & FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.
Heil Engineering Co., Cleveland, Ohio.

PLASTIC TESTERS—
Scott, Henry L., Co., Providence, R. I.

POTS—Lacquer
Industrial Oven Engr. Co., Cleveland, Ohio.

POTS—Lead Melting
Robertson, John, Co., Brooklyn, N. Y.

POWDER—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Homer, N. Y.
Magnus Chemical Co., Garwood, N. J.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

PRESSES—Hydraulic and Mechanical
Robertson, John, Co., Brooklyn, N. Y.
Standard Machinery Co., Providence, R. I. (Mechanical Only)

PRESSES—Lead
Robertson, John, Co., Brooklyn, N. Y.

WHERE TO BUY, Continued

PRESSURE VESSELS—
National Annealing Box Co., Washington, Penna.

PULLERS—Wire
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.

REEL AND TENSION STAND—
Fidelity Machine Co., Philadelphia, Pa.
Industrial Oven Engr. Co., Cleveland, O.
Moslo Machinery Co., Cleveland, Ohio.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS—Annealing and Stranding
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B.. Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS AND SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Takeoff
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Traverse
Hubbard Spool Co., Chicago, Ill.
Stevens Metal Products Co., Niles, Ohio.

REELS—Vulcanizing & Impregnating
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REFRACTORIES—High Temperature
Norton Co., Worcester, Mass.

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N. Y.

RODS—Wire—Non-Ferrous
Aluminum Co. of America, Pittsburgh, Pa.
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

ROLL STRAIGHTENERS—
Moslo Machinery Co., Cleveland, Ohio.

ROPE—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Brewer Mfg. Co., Muncy, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott, Henry L., Co., Providence, R. I.

RUST PROOF COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

RUST REMOVING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

SATURATION SYSTEMS—
Industrial Oven Engr. Co., Cleveland, Ohio.

SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

SHEET—Steel
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

SOAPS—Industrial and Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Potter, Neil C., Newark, N. J.
Procter & Gamble, Cincinnati, Ohio.
Standard Industrial Compounds Co., Chicago, Ill.

SOLVENT RESIN SYSTEMS—Experimental
Industrial Oven Engr. Co., Cleveland, Ohio.

SPOOLS—Annealing and Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

SPOOLS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

SPRINGS—Steel
Wickwire Spencer Steel Co., New York, N. Y.

STAMPINGS—Steel
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRAND—Steel and Copper
Brewer Mfg. Co., Muncy, Pa.

STRIP—Brass and Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.

STRIP METAL TESTERS—
Scott, Henry L., Co., Providence, R. I.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.

TANK LININGS—Brick
Ceilcote Co., The, Cleveland, Ohio.
Keagler Brick Co., Steubenville, Ohio.
Nukem Products Corp., Buffalo, N. Y.

TANKS—Pickling
Haveg Corp., Newark, Del.
Heil Engineering Co., Cleveland, Ohio.
Nukem Products Corp., Buffalo, N. Y.
Sauereisen Cements Co., Pittsburgh, Pa.

TANKS—Steel
Mossberg Pressed Steel Corp., Attleboro, Mass.

TEMPERATURE CONTROLS—
Niagara Blower Co., Buffalo, N. Y.

TENSILE TESTERS—
Scott, Henry L., Co., Providence, R. I.

TESTING INSTRUMENTS—
Scott, Henry L. Co., Providence, R. I.

TOOLS—Wire Cutting
Porter, H. K., Inc., Everett, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

TREADS—Safety
Norton Co., Worcester, Mass.

TRUCKS—
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

TUBE BENDERS AND FORMERS—
Ruesch, H. J., Machine Co., Newark, N. J.

TURKS HEADS—Friction and Power Driven
Standard Machinery Co., Providence, R. I.

VALVES AND FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Eisler Engineering Co., Newark 3, N. J.
Micro Products Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.

WIND-UP AND UNWIND SYSTEMS—Continuous
Entwistle, James L., Co., Pawtucket, R. I.
Industrial Oven Engr. Co., Cleveland, Ohio.

WIRE—Aluminum
Aluminum Co. of America, Pittsburgh, Pa.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE—Cold Heading
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE—Electric
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.

WIRE—Enameled for Coils
North American Philips Corp., Dobbs Ferry, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Wickwire Spencer Steel Co., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE—Music
American Brass Co., The, Waterbury, Conn.
Jersey Steel & Wire Corp., Irvington, N. J.
Johnson Steel & Wire Co., Worcester, Mass.

WIRE—Nickel Silver and Phosphor Bronze
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.

WIRE—Non-Ferrous to Specification for Special Purposes
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
North American Philips Corp., Dobbs Ferry, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Spring
American Brass Co., The, Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Johnson Steel & Wire Co., Worcester, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Wickwire Spencer Steel Co., New York, N. Y.

WIRE—Stainless Steel
Firth-Sterling Steel Co., McKeesport, Pa.
Jersey Steel & Wire Corp., Irvington, N. J.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Worcester, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Wickwire Spencer Steel Co., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE AND STRIP—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

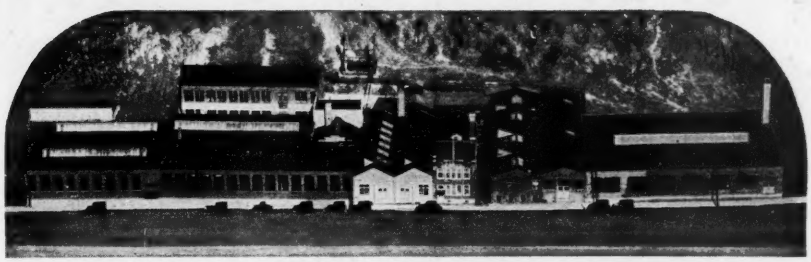
WIRE TESTERS—
Scott, Henry L., Co., Providence, R. I.

WIRE, WEAVING—Non-Ferrous
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.

WRAPPING PAPER—Creped
Crepe-Kraft Co., Newark, N. J.

YARN TESTERS—
Scott, Henry L., Co., Providence, R. I.

HUDCO



HUDSON WIRE CO. PLANT AT OSSINING, N. Y.

This plant is one of the most up-to-date and completely equipped plants in the world for the production of "HUDCO" fine wires in all metals.

ESTABLISHED IN 1902

HUDCO

WIRES FOR METAL SPRAYING

Pure lead, Lead Alloy, Pure Zinc, Zinc Alloy, Copper, Tin, High Brass, Low Brass, Solder Wire, High Conductivity, Electric Wire. Cadmium, Nickel Silver, Aluminum, Monel Metal, Phosphor Bronze, Pure Nickel, Commercial Bronze, Brush Wires, Crimp and Straight, Brass, Steel, Nickel Silver, Copper and Phosphor Bronze.

HUDCO

FINE BARE WIRES

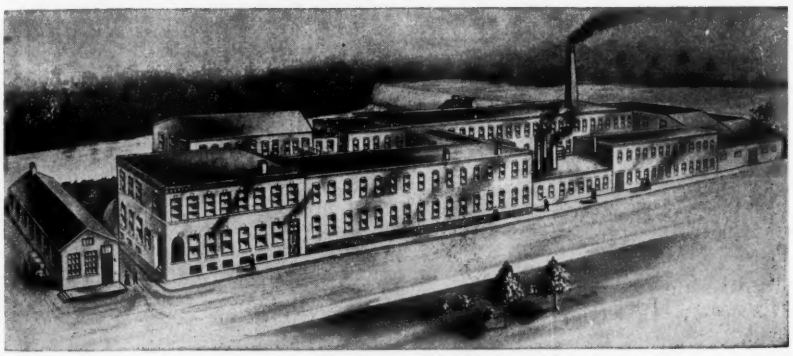
High Brass, Low Brass, Zinc 99.99+ and High Tensile Zinc, Commercial Bronze, Phosphor Bronze, Pure Tin, Lead, Antimonial Lead, Tinsel Lahns, Silver Plated Copper, False Gold and Copper. Cadmium, Nickel Silver, Silver Plated Copper, False Gold and Special Brass and Bronze Alloys to Specification, Metallic Fibre for Packing Purposes, Copper, Bronze, Zinc, Lead and Aluminum.

"HUDCO" specially processed Copper Wire for enamelling purposes is drawn from Selected Copper, insuring the maximum conductivity. This is but one example of the use of the most advanced and approved materials and methods in our processing.

BETTER WIRE AT LOWER COST

Send Us Your Specifications and Let Us Quote Prices

HUDSON WIRE COMPANY • OSSINING, N. Y.



Winsted Division of HUDSON WIRE CO. at Winsted, Conn. modern and completely equipped enamelled wire plant for LEAKPROOF ENAMELLED WIRE and all standard and special coverings.

WINCO

"WINCO" enamelled wire is drawn from special selected copper, assuring perfect enamelling. All wire tested before shipment.

"WINCO" enamelled wire is available in all standard and special coverings made to meet exacting requirements.

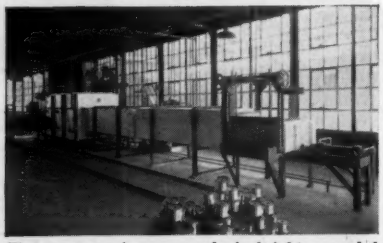
Samples of LEAKPROOF and other enamelled wires sent on request

WINSTED DIVISION OF HUDSON WIRE COMPANY

WINSTED, CONN.

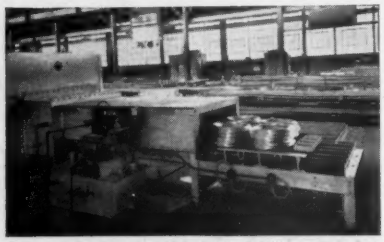
EF FURNACES

For Every Industrial Heat Treating Process



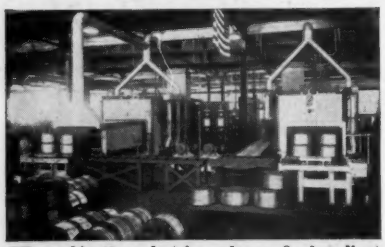
Fine copper wire on spools is bright annealed in this EF continuous pusher type furnace.

High carbon and alloy steel wire and rod are annealed without decarb in these EF pits.



Brass, bronze, copper and nickle-silver wire and strip are annealed in this EF continuous furnace.

EF gas fired bell type furnaces maintain uniform temperature throughout charge regardless of size.



EF combination electric and gas fired radiant tube furnaces bright annealing copper wire or reels—each furnace handles 2500 lbs. per hour.

We build Gas Fired, Oil Fired, and Electric Furnaces

PRODUCTION FURNACES ENGINEERED TO FIT THE JOB

Furnaces for Any Process, Product, or Production

ALL TYPES OF FURNACES AVAILABLE

With the background of over 25 years of practical furnace building experience and with hundreds of designs, types, and combinations of types available which have proven successful on various applications, THE ELECTRIC FURNACE CO. is prepared to design and build any size or type of furnace required for any industrial heat treating process.

IMPARTIAL ANALYSIS OF CUSTOMERS REQUIREMENTS

As designers and builders of both electric and fuel fired equipment, EF engineers are in a position to make an impartial analysis of any company's furnace or heat treating problem and recommend, design, and build the best size and type for the job.

EF DESIGNING AND MANUFACTURING FACILITIES

With a large and experienced engineering staff, and with our own experimental and research departments, structural shop, machine shop, pattern shop, transformer shop, and adequate available foundry service, THE ELECTRIC FURNACE CO. is largely a self contained unit. This centers the responsibility of engineering, manufacturing, assembling, and installing in one large and competent organization.

EF FURNACES ARE BUILT FOR EVERY PROCESS INCLUDING

Annealing	Copper Brazing	Normalizing
Aluminum Brazing	Drawing	Process Heating
Billet Heating	Enameling	Scale-free Hardening
Bright Annealing	End Heating	Silver Soldering
Bright Hardening	Forging	Spherodizing
Ceramic Firing	Hardening	Sintering Powder Metal Products
Carburizing	Malleablizing	
Clean Annealing	Nitriding	Stress Relieving

EF FURNACES ARE BUILT IN VARIOUS TYPES INCLUDING

Bell and Box Types	Hearth Types	Roller Hearths
Car Types	Mesh Belt Conveyor	Roller Rail
Chain Belt Conveyor	Pit Types	Rotary Drum
Chain Strand Conveyor	Pusher Types	Rotary Hearths
Comb. Electric and Fuel	Reciprocating Hearth	Suspended Conveyor
Continuous—Misc. types	Radiant Tube	Vertical Cylinder
Forging Furnaces	Recuperative	Walking Beam, etc.

ACCESSORIES WE BUILD FOR EF FURNACES INCLUDE

Automatic Pushers	Gas Preparation Units	Time and Labor Saving Material Handling Equipment
Charging Machines	Pressure Systems	
Continuocs Quench Tanks	Pumping Equipment	
Control Panels	Quenching Machines	Transfer Mechanism
Conveyor Equipment	Spec. Atmos. Generators	Transformers
Gantry Cranes	Switchboards	Metal Washing Machines

INDUSTRIES using EF EQUIPMENT for VARIOUS PROCESSES INCLUDE

Automotive and Aircraft	Ceramic and Chemical	Radio and Refrigeration
Aluminum and Magnesium	Copper and Brass Plants	Stamping and Forging
Agriculture Implement	Electrical Appliance	Tractor and Truck
Air Conditioning	Iron and Steel Casting	Wire, Rod, Tubing and Strip (ferrous and non-ferrous)
Ball and Roller Bearing	Malleable Iron	
Bolt and Nut Mfgrs.	Motor and Engine	

EF engineers have been able to improve heat treating processes, increase furnace production capacities or reduce the cost of heat treating operations in hundreds of prominent plants. Phone 4661 Salem, Ohio. Their services are available at your plant or at our offices.

Our large and experienced engineering staff and ample manufacturing facilities enable us to make reasonably prompt deliveries.

Submit your production furnace or kiln problems to EF engineers. No job is too large or too unusual.

The Electric Furnace Co., Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces---For Any Process, Product or Production